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РЕЗЮМЕ

ТЕХНИКА КУЛЬТИВИРОВАНИЯ ТКАНИ КАРТОФЕЛЬНОГО КЛУБНЯ В ТЕЧЕНИЕ КОРОТКОГО ПЕРИОДА

В. ФАЛУДИ

Для ткани картофельного клубня *Solanum tuberosum* L. был разработан метод недифференцированного культивирования в течение короткого периода. Сохранение недифференцированной ткани требует особой заботы. Необходимо определить оптимум для каждого отдельного условия (фактора). Ниже приводятся полученные в нашей работе результаты, относящиеся к требованиям питательной среды.

Среди минеральных питательных сред применение измененного — White — состава является удовлетворительным во всех отношениях. Как дополнительное, но незаменимое питательное вещество необходимо давать энзиматический казеингидролизатум 50—75 мг на литр. Принимая во внимание семигетеротрофные требования ткани при добавлении Д-глюкозы, сахарозы или трехалозы является удовлетворительным примерно в одинаковой степени. С этой целью сахарозу можно давать в 0,5—1,0% и не более 2,0% концентрации. Сахароза более высокой концентрации оказывает вредное или определенно токсическое влияние.

Хорошим регулятором роста является 2,4-Д при оптимальной концентрации в зоне 10^{-4} М. Примерно такое же влияние оказывают некоторые его аналоги, как 3,4-дихлорфеноксиуксусная кислота, МСРА. Влияние гормональных ростовых препаратов, имеющих другой тип молекулы (IAA, 1-NAA и 2-NOXA) показывает некоторые отклонения, частично в зависимости от типа молекулы или от примененной концентрации.

Важно обеспечить соответствующую гелевую структуру агар-агара в пределах 0,8—1,0% в зависимости от температуры.

ИЗУЧЕНИЕ ЭФФЕКТА ПРЕПОСЕВНОЙ ОБРАБОТКИ СЕМЯН СОИ (CLYCINE MAX)

МАЛЕИНОВЫМ ГИДРАЗИДОМ

С. СЕН, Б. К. ДАЗ АДХИКАРИ

Проведенные исследования показывают, что предпосевная обработка семян сои малеиновым гидразидом может быть полезной в получении лучшего урожая, и, что концентрация и длительность обработки являются двумя важнейшими факторами в ее практическом использовании.

ОТРАЖЕНИЕ ВНЕШНЕЙ ОБЕСПЕЧЕННОСТИ В СОДЕРЖАНИИ NPK РАСТЕНИЙ

В. ФРЕНЬО, Й. П. МИХАЙФИ

В данной работе было определено, что концентрация питательных элементов в тканях растения изменяется не постепенно, а скачками даже в том случае, если внешняя обеспеченность изменяется постепенно. Авторы исследовали происходящие изменения в квантах у проростков *Sinapis alba*. Этот опытный объект с точки зрения простоты пригоден для выяснения данной проблемы. Кроме обычных биологических проблем разрешение приведенного здесь вопроса также важно для определения увеличения обеспеченности растений питательными веществами.

ГИБРИДЫ *SOLANUM MELONGENA* L. × *SOLANUM GILO* RADDI

Д. ПАЛ, Э. РАЙКИ

С целью получения межвидовых гибридов были скрещены два сорта *S. melongena* L., а именно обыкновенный лиловый (болгарский) и белый баклажан с *S. gilo* Raddi. Скрещивания оказались удачными в случае, когда в качестве материнской формы использовались растения *S. melongena* L., а в качестве отцовской — *S. gilo* Raddi, в противном случае гибридные семена не были получены. Полученные гибриды обладали признаками обоих родительских форм, но доминировали признаки *S. gilo* Raddi.

ПРЕДВАРИТЕЛЬНОЕ СООБЩЕНИЕ О ТРАНСЛОКАЦИИ ЕСТЕСТВЕННОГО РАДИОАКТИВНОГО ИЗОТОПА $^{40}_{19}\text{K}$ В ПРОРАСТАЮЩИХ СЕМЕНАХ МЯГКОЙ ПШЕНИЦЫ

Ф. ПЕШЕК

В опытах изучались локализация и транслокализация естественного радиоактивного изотопа $^{40}_{19}\text{K}$ в прорастающих семенах мягкой пшеницы. В соответствующей литературе не было еще работы, занимавшейся этой проблемой; данное сообщение может способствовать лучшему пониманию метаболических изменений, происходящих в прорастающих семенах.

ИЗМЕНЕНИЕ КЛЕТОК КОНУСА НАРАСТАНИЯ КОРНЕЙ ВВИДУ НЕДОСТАТКА ПИТАТЕЛЬНЫХ ВЕЩЕСТВ

М. МАРОТИ, И. Д. ДЕР

Авторы изучали изменения, происходящие в обмене веществ в конусах нарастания корней кукурузы и бобов, вызванные голоданием, по весу, содержанию сухого вещества, количеству NS—P и количеству клеток. На основании опытов определено, что искусственное голодание вызывает быстрое уменьшение веса и содержания сухого вещества, деление клеток прекращается. Сокращается количество NS—P фракций, но это сокращение гораздо меньше, чем уменьшение веса. Последнее явление изменяется в зависимости от вида растений, так у кукурузы обе NS—P фракции уменьшились под влиянием 9-дневного голодания, а у бобов едва заметное изменение наблюдалось под влиянием 7-дневного недостатка питательных веществ.

ПРЕДОТВРАЩЕНИЕ ОТРАВЛЕНИЯ АММОНИЕМ ПРИ СКАРМЛИВАНИИ КАРБАМИДОМ

И. САБО

Автором получены препараты карбамида длительного действия. Препараты карбамида по сравнению с соответствующей дозой кристаллического карбамида замедленно растворяются в жидкости рубца. Определено, что применение препаратов P_{16} , и в большей степени P_{22} вызывает медленное образование аммония из карбамидного препарата, что предохраняет организм овец от отравления. Для усвоения медленно выделяющегося из препарата аммония имеется достаточно времени для микроорганизмов, находящихся в рубце; всасанный же при больших дозах карбамида аммоний печень способна нейтрализовать.

При соответствующем соотношении карбамидного препарата и корма создается возможность рационального поглощения таких доз карбамида, которые в два-три раза превышают принятые до сих пор дозы. На основании исследований токсическое влияние аммония можно исключить таким способом, что одновременно с этим можно повысить использование нитрогена при определенных условиях.

ДИФФЕРЕНЦИАЦИЯ, МИКРОСКОПИЧЕСКОЕ И СУБМИКРОСКОПИЧЕСКОЕ СТРОЕНИЕ ОБОЛОЧЕК ГИГАНТСКИХ КЛЕТОК ПЕРИКАРПИУМА У

CAPSICUM ANNUUM L.

Л. ФРИДВАРСКИ, Ю. НАДЬ

Авторы исследовали оболочки гигантских клеток с помощью фазово-контрастного и поляризационного микроскопов. Определено, что двойное преломление оболочки этих клеток негативное, т. е. ориентация микрофибриллума обычно трансверсальное. Далее, распознан и описан факт, что структура оболочки гигантских клеток, — главным образом по виду торусных пор, — в разных сторонах клетки разная, в зависимости от того, с каким типом клеток или тканью она соприкасается. Удалось определить четыре разности структуры оболочки гигантских клеток в соответствии с типом соседних клеток

СООБЩЕНИЕ О НЕКОТОРЫХ ВИДАХ ЧЕРВЕЦОВ (НОМОПТЕРА, СОССОИДЕА) ВЕНГЕРСКОЙ ФАУНЫ

Б. ЗАК-ОГАЗА

Польский автор в течение годичного пребывания в Венгрии в 1964 г. собрала 16 различных видов червецов: 15 видов в окрестностях Томпа, 1 вид в Будапеште. Среди них 9 видов являются новыми в венгерской фауне. Названия их: *Trionymus aberrans* Goux (*Mirococcopsis stipae* Borchs., *Mirococcus clarus* Borchs., *Heterococcus borhksenii* Morr.), *Rhizococcus insignis* (Newst.), *Rh. cynodontis* (Kir.), *Greenisca glyceriae* (Green), *Lecanopsis festucae* Borchs., *Parafairmairia delicata* Borchs. Два следующих вида (*Trionymus* sp. и *Atrococcus* sp.) являются новыми в науке. Описание их будет дано в отдельной статье. Оставшиеся пять видов уже встречались в венгерской фауне. Автор передала на сохранение Будапештскому Государственному Музею Естественного микроскопические препараты новых для Венгрии видов червецов.

БИОХИМИЯ ЯРОВИЗАЦИИ

V. ОБРАЗОВАНИЕ РИБОНУКЛЕАЗЫ 1 И ЕЕ ЛОКАЛИЗАЦИЯ

М. ДЕВАИ

Исследовались условия образования и локализации рибонуклеазы 1, которая, как предполагается, принимает участие в процессе яровизации. Было определено, что рибонуклеаза 1, образующаяся под влиянием низких температур, локализуется в точках роста побегов. Активность RN-азы в гомогенизате создается в два этапа.

Показано, что для образования рибонуклеазы 1 необходимо одновременное присутствие ряда компонентов, в том числе протеиновой базы и одного фермента, или системы ферментов. Система, активизирующая рибонуклеазу 1, активна при температуре 0° и вместе с рибонуклеазой 1 принимает участие в обмене веществ процесса яровизации.

МОРФОЛОГИЧЕСКИЕ И ЦИТОЛОГИЧЕСКИЕ ОСОБЕННОСТИ НЕКОТОРЫХ МЕЖВИДОВЫХ ГИБРИДОВ Т. ТИМОРНЕЕВИ ZHUK.

А. БЕЛЕА

Изучались морфологические и цитологические особенности различных межвидовых гибридов *T. timopheevi* Zhuk. первого и последующих поколений. В первом поколении обычно гибриды были однообразными и обладали промежуточными признаками. Во втором поколении у исследованных гибридов наблюдалось чрезвычайно разнообразное расщепление. В случае, если одной из родительских форм была *T. timopheevi* Zhuk., а другой — форма, отличавшаяся по геномной гомологии и числу хромосом, то в редукционном делении наблюдалось особенно большое количество отклонений.

ЭЛЕКТРОНМИКРОСКОПИЧЕСКОЕ ИССЛЕДОВАНИЕ ЭКСТРАЦЕЛЛЮЛЯРНЫХ КАТЕХОЛАМИНОВЫХ ЗЕРЕН НАДПОЧЕЧНОЙ ЖЕЛЕЗЫ ЦЫПЛЕНКА

И. БЕНДЕЦКИ

В опыте изучалось ультраструктурное строение нормальной и подвергнутой холодной обработке надпочечной железы двухнедельного зародыша цыпленка, особое внимание уделяли катехоламиновым зернам клеток железы, которые расположены рядом с синусоидами, и изменению структуры синусоидов. Определено, что эмбриональное развитие в это время в клетках надпочечной железы хорошо можно дефинировать, катехоламиновые зерна и органеллулы клеток уже имеются. Иногда, при нормальном состоянии надпочечной железы в синусоидах клеток имелись одно-два катехоламиновых зерна. Под влиянием холодной обработки, 1 час при 0° в синусоидах клеток надпочечной железы можно было наблюдать большое количество бугорков на цитоплазматическом отростке, содержащих катехоламиновые клетки, было отмечено их отделение в лумене и появление в циркуляционной системе. Наблюдаемое явление мы рассматриваем как специальную форму индуцированной катехоламиновой экстррузии.

ИЗМЕНЕНИЕ ПИГМЕНТОВ В ЭТИОЛИРОВАННЫХ ЛИСТЬЯХ ЯЧМЕНЯ

М. ХОРВАТ, Д. ЛАСТИТИ

Этиолированные листья ячменя были изолированы в воде, в 10^{-4} молевом растворе кинетина и вместе с интактными листьями подвергались непрерывному освещению и освещению в течение короткого времени. В каждом варианте опыта были также цельные этиолированные растения. Определено, что кинетин совместно со светом действовал на компоненты пигмента еще некоторое время и после изоляции, и только затем проявлялись признаки разрушения пигмента. Но один кинетин не мог задержать разрушения пигмента, наступавшее в темноте, даже в течение короткого времени.

ИЗМЕНЕНИЕ ТОЛЩИНЫ ОБОЛОЧКИ ЗЕРНА ПШЕНИЦЫ В ЗАВИСИМОСТИ ОТ СОРТА И УСЛОВИЙ ВЫРАЩИВАНИЯ

Ж. ПОЛХАМЕР

В Сельскохозяйственном научно-исследовательском институте Венгерской Академии наук, в Мартонвашаре, в мукомольно-хлебопекарной лаборатории в 1962 и 1964 гг. исследовались в различных опытах, с одной стороны, различия по толщине оболочки у ряда сортов озимой пшеницы, с другой стороны, влияние условий выращивания на толщину оболочки. На основании полученных данных видно, что существует значительная разница между сортами по наследуемому признаку-толщине оболочки, который явно проявляется при определенных условиях. Под влиянием дозы навозного удобрения оболочка увеличивалась. Больше всего она увеличивалась при полном удобрении. Опыты были заложены в 10-ти различных местах страны. В опытах, заложенных на Большой низменности на черноземе, где количество осадков небольшое, качество оказалось лучшим, хотя, в то же самое время, оболочка зерна оказалась большей. На основании данных ряда опытов можно было определить, что толщина оболочки у сорта Безостая 1, как при сравнении с другими сортами, так и при сравнении с различными вариантами опыта, была наименьшей, т. е. соотношение ее к другим частям зерна было наиболее благоприятным.

ПОЛУЧЕНИЕ ГИБРИДНОЙ ДЫНИ

А. КИШШ

На основании 5-летних опытов удалось получить мелкоплодную с хорошим вкусом и продуктивностью гетерозисную (гибридную) дыню. Наилучшая комбинация получена при скрещивании мелкоплодной американской дыни Dew Green и крупноплодной венгерской — Маршовски. В Госсортиспытании этот гибрид оказался по продуктивности лучше, чем существующие сорта и в 1964 г. он получил предварительное государственное признание.

РЕЗУЛЬТАТЫ ОПЫТОВ ПО АГРОТЕХНИКЕ ПЕРВОГО ВЕНГЕРСКОГО ГИБРИДА СУДАНСКОЙ ТРАВЫ

Э. КЮКЕДИ

В 1963—64 гг. проводились опыты по определению производственной ценности первого венгерского гибрида суданской травы (Хибар Мв 301, Хибар Мв 309). Урожай гибридов суданской травы сравнивался с кечкеметской сахарной суданской травой, которая использовалась в качестве стандарта, при четырех сроках посева (20 апр., 4 мая, 18 мая, 1 июня). Результаты 2-х летних опытов в среднем по четырем срокам посева показали, что гибрид Хибар Мв 301 превысил по урожаю зеленой массы сладкую суданскую траву на 37,3%, а гибрид Хибар Мв 309 — на 31,9%.

Оптимальные условия посева наблюдаются тогда, когда температура почвы на глубине 4—5 см достигнет 14—15°.

ОПЫТ ПО СИЛОСОВАНИЮ ЛЮЦЕРНОВОЙ МЯЗГИ

Л. МЕНТЛЕР

Опыт был поставлен для того, чтобы определить можно ли данным методом получить силос хорошего качества для свиней. Было определено, что размельчение не является приемлемым методом силосования люцерны.

ДАННЫЕ О ВОЗМОЖНОСТИ ЗАЩИТЫ ПРОТИВ ВИРУСОВ КАРТОФЕЛЯ

II. Общий обзор различных способов защиты и зараженности вирусом различных сортов картофеля

И. ХОРВАТ

В первом сообщении приведены общие возможности против вирусов картофеля в пределах изученных практических способов, а также общие и характерные патологические, производственные и биологические признаки опытных сортов картофеля (Шомоди Кифли, Гюльбаба, Кишвардаи Рожа, Минденеш, Шомоди корай, Шомоди шарга).

УСЛОВИЯ ОПОЛОДТОВРЕНИЯ СОРТОВ ЯГОДНЫХ КУЛЬТУР

II. Земляника — крыжовник

А. ШЕЛЯХУДИН, Ш. БРОЗИК

Земляника. Исследованные 24 сорта являются самоопылителями. При свободном опылении завязывание плодов было на 20—50% лучше, что доказывает необходимость наличия сортов-опылителей. У ряда сортов, склонных к партенокарпии, проявление этого явления представляет собой постоянный сортовой признак.

Крыжовник. Исследованные 10 сортов сильно варьируют по склонности к самооплодотворению. Свободное опыление вызывало повышение урожая на 30—50%. У исследованных сортов наблюдалось также и явление партенокарпии.

ИССЛЕДОВАНИЯ ПО ГИБРИДНОЙ ПШЕНИЦЕ В МАРТОНВАШАРЕ

Э. РАЙКИ, Ш. РАЙКИ

После изложения детального литературного обзора авторы приводят результаты своих исследований в области: 1) генетической системы цитоплазматической мужской стерильности и восстановления фертильности, 2) гетерозисного эффекта и 3) опыления пшеницы в связи с семеноводством гибридной пшеницы.

В полевых и тепличных условиях некоторые источники цитоплазматической мужской стерильности и восстановления фертильности показали себя стабильными и функционирующими. В зависимости от подлинный, отобранных из источника восстановления фертильности, а также и от сортов пшеницы, точнее от биотипов, отобранных из тех же сортов, подвергающихся переводу в восстановителя, эффективность создаваемых восстановителей может варьировать. Могут представлять интерес результаты, сообщенные о диаметре фертильной и стерильной пыльцы, а также и об изменении цвета и формы, наблюдавшихся при анализе пыльцы.

В опытах по изучению комбинационной способности, заложенных при двух площадках питания (10×5 и 10×10 см), в четырехкратной повторности, по сравнению с лучшим стандартом особенно одна комбинация ($Y \times X$) показала в первом гибридном поколении значительный гетерозис. В настоящее время родительские сорта этой комбинации находятся в посевах $Ms y^3$ и $Rf x^3$.

На основании работ уже в большей части опубликованных авторы коротко суммируют результаты опытов по изучению цветения пшеницы, которые могут быть использованы при семеноводстве гибридной пшеницы.

ИЗУЧЕНИЕ АКТИВНОСТИ МЕДОНОСНЫХ ПЧЕЛ, ОПЫЛЯЮЩИХ ЛЮЦЕРНУ В ВЕНГРИИ

З. БОЙТОШ

На участке люцерны площадью в 52 га на различном расстоянии от ульев исследовали влияние медоносных пчел на оплодотворение и завязывание семян. Проводили также наблюдения за действиями неопытных молодых и опытных взрослых пчел при открытии цветков во время сбора нектара. В тех двух местах, где количество медоносных пчел было наибольшим завязывание семян было на 34, точнее говоря на 35% выше, чем в наиболее удаленных от ульев местах, где только дикие пчелы могли посещать люцерну. При сборе нектара неопытные молодые пчелы открывали, в среднем, 50% посещенных ими цветков, в то время как взрослые опытные пчелы открывали лишь 4—6%.

TECHNIQUES OF MAKING SHORT-TERM TISSUE CULTURES OF POTATO TUBERS

I. EFFECT OF THE COMPOSITION OF THE GROWTH MEDIUM

By

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A method was elaborated for the growth of short-term, undifferentiated cultures of tuber tissues of *Solanum tuberosum* L. Special care is required to secure undifferentiated tissue. The optimum of all conditions is to be determined separately. In the present study the results of examining the growth medium requirements will be described.

Among mineral media, a modified White solution is applicable under all circumstances. An amount of enzymatic caseinhydrolyzate (50—75 mg/l) is indispensable as a supplementary nutrient. In consideration of the semiheterotrophic requirements of the tissue, additions of D-glucose, saccharose and trehalose are almost equally satisfactory. For this purpose 0.5—1 per cent of saccharose may be added but at concentrations not higher than 2 per cent. Greater concentrations of saccharose are harmful or explicitly toxic.

2,4-D 10^{-4} M is a very good growth regulator in the optimum concentration zone. Certain of the analogues (3,4-dichlorophenoxyacetic acid, MCPA) have a similar effect. The effect of hormone-type growth regulators with different molecular types (IAA, 1-NAA and 2-NOXA) shows deviations depending partly on the type of molecules and partly on the concentration used.

The insurance of the proper agar-agar gel structure which depends on keeping the temperature within 0.8—1.0 per cent is important.

Introduction

We possess only sporadic data on the short-term culture method of tissues (BURKHOLDER—NICKELL 1949, HENDERSON 1954, STEWARD—CHAPLIN 1954). Several authors state that, depending on the species, the metabolism of the tissues and even their type of growth essentially change after a period of growth longer than 2 to 4 weeks. Thus only undifferentiated short-term cultures are suitable for dependable metabolic examinations.

Undifferentiated, short-term cultures are characterized by slightly opalescent, cream colouring, a medium hyperhidric character and an explicitly tuberous surface (GAUTHERET 1943, FALUDI 1957). A good sign of undifferentiation is the absence of polarization (NOBÉCOURT 1938, FALUDI 1957). The significant number of elongated cells is striking in the presence of the relatively slight initial cell division seen under the microscope. These appear on the surface as configurations of multi-nuclear cells resembling filamentous algae (FALUDI et al. 1961).

Material and Methods

Our experiments were made for the requirements of meristem cultures cut from the tissues of tubers of potatoes. The meristems of tuber tissues are not prone to spontaneous differentiation (NOBÉCOURT 1938) and their growth can be easily induced by auxin (GAUTHERET 1939). The growth of the tuber tissues of *Solanum tuberosum* L. can be essentially more easily induced by auxinherbicides than by natural auxin (STEWART—CAPLIN 1951).

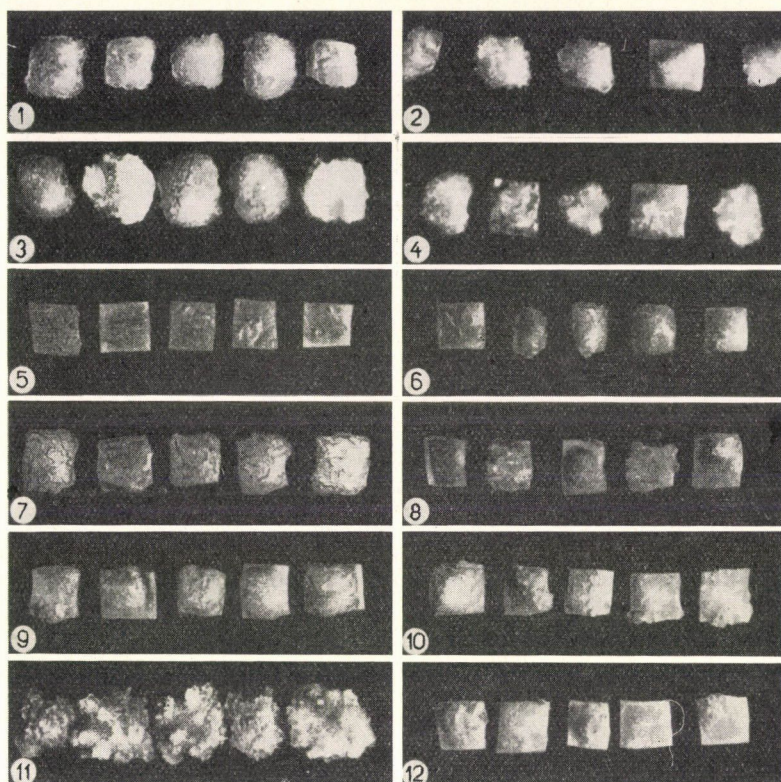


Fig. 1. The types and measure of growth ($\text{mg} \pm s_x$) of various potato varieties after 14 days of growth

Gül Baba	$81 \pm 1,80$	Lenino	$38 \pm 1,43$
Korai Rózsa	$83 \pm 3,97$	Ella	$37 \pm 4,20$
White City	$56 \pm 1,56$	Mercur	$34 \pm 1,43$
Früherste	$45 \pm 1,37$	Express	$27 \pm 2,14$
Béta	$44 \pm 2,36$	Aquila	$25 \pm 3,80$
Delta	$39 \pm 5,45$	Margit	$23 \pm 3,70$

We have examined the suitability of 12 varieties of *Solanum tuberosum* L. for culture (Fig. 1). The culture technique was elaborated for the *Gül Baba* variety which most readily reacts to 2.4-D.

After cleansing the tuber in fatty alcohol, it was disinfected for 20 minutes in 2% benzolsulphonchloramide (Neomagnol) solution. After removing the peel in a sterile case, blocks of approximately 25×25 mm in surface were cut from the tuber. Transverse sections were made with a microtome placed in the box. (Fig. 2) and divisions at right angles to the surface were made with a modified knife composed of a series of razor blades (BOURIQUET 1952).

The experiments were set up in a way that there would be an equal number of pieces from every level in every variant. Twenty-five milliliter oven-proof glass flasks (Rasotherm) were used as culture vessels. Approximately 5 to 8 explants were placed in each vessel.

The results were evaluated on the basis of fresh weight and macroscopic photographs were made. Statistical evaluations were done on the basis of 50–120 tissue pieces (WEBER 1963).

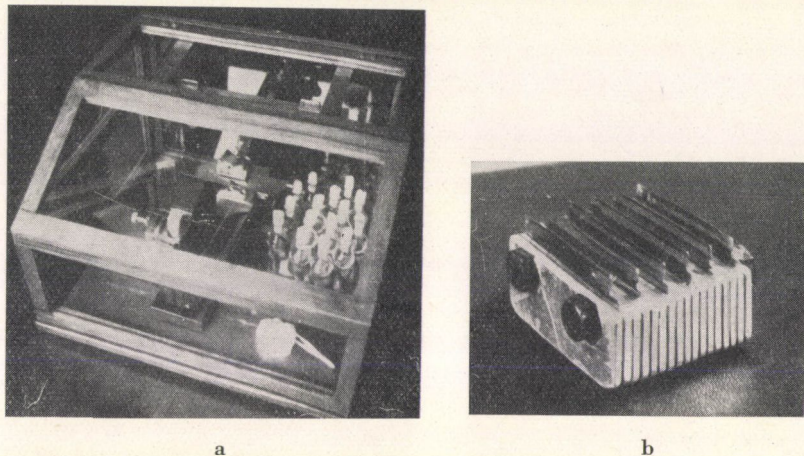


Fig. 2. Sterile case (a) and adjustable knife series (b) prepared for making tissue sections

Experimental

Effect of mineral growth media

Among the nearly 100 nutrient solutions occurring in the literature (PETRU—ŘETOVSKY 1956), we examined the affect of the ten mineral growth media most frequently employed in the culture of normal tissues (Table 1).

From the nature of the growth or from the sizes seen in the table, it can be seen that no nutrient solution had a toxic effect. The distilled water control which, in addition to the 4 mg/l K ions used in the solution of the 2,4-D auxinherbicide, practically contained no other mineral substance showed a rather considerable growth even in comparison to the 25 ± 0.11 mg initial weight. But the comparison of the variation coefficient and the values for the weight increase of the tissues expressed in the control percentage calls our attention to the fact that the composition of mineral substance is not an insignificant factor. At first sight Heller's medium, closest to White's nutrient solution, seems to be the most appropriate. The percentage of variation of the two are practically the same.

We employed a modified WHITE's medium in our work (MAUNEY et al. 1952). The significant pH stability of this growth medium does not considerably change during autoclaving (STREET 1959).

Table 1
*Effect of the composition of mineral media
 on the growth of potato tissue cultures*
 (time cultures were made: Dec. 1963)

Nutrient solutions	Weight of tissues on the 14th day mg \pm s_x	V%	Absolute weight incr. mg	Control per cent
0	76 \pm 1.56	2.1	51	100
BONNER-DEVIRIAN	127 \pm 2.20	1.7	102	200
GAUTHERET	122 \pm 2.60	2.1	97	190
HELLER	148 \pm 2.59	1.7	123	241
KNUDSON	92 \pm 2.24	2.4	67	131
NITSCH	130 \pm 2.68	2.1	105	206
PRJANYISNYIKOV	150 \pm 2.78	1.9	125	246
RANDOLPH-COX	121 \pm 2.80	2.3	96	188
ROBBINS	122 \pm 1.96	1.6	97	190
SKOOG	103 \pm 1.64	1.6	78	153
WHITE	104 \pm 1.64	1.6	79	155

Effect of organic nitrogen

Previous to our work the culture of potato tuber tissues was unsuccessful without supplementing the medium with coconut milk or other complexes containing some unknown active ingredient (STEWART—CHAPLIN 1951, CHAPMAN 1955).

We found that enzymatic casein hydrolyzate in proper concentration is perfectly capable of supplementing the growth conditions (Table 2).

Table 2
*Effect of different concentrations of casein hydrolyzate
 on the growth of potato tissue cultures*
 (Cultures were made in Nov. 1960)

Casein concentr. mg/l	Fresh weight mg \pm s_x	V%	Absolute weight Incr. mg	N. I.
25	61 \pm 2.2	3.6	35	2.3
75	128 \pm 1.3	1.0	103	5.0
125	85 \pm 1.3	1.5	59	3.3
175	38 \pm 1.3	3.7	12	1.5
Initial Weight mg	26 \pm 0.8	3.1	—	—

N. I. = growth index = final weight mg/initial weight mg

The table shows that the optimum concentration of casein hydrolizate is approximately 75 mg/l. This is fairly close to the values which STEWARD—CAPLIN (1952) used for the growth medium of *Daucus carota* L. cultures, but it is much lower than that which HARRIS (1956) found optimal at a value of 400 mg/l. It should be noted that the latter casein hydrolizate was employed as the only source of N (approx. 2 mM/l).

Effect of carbon sources

The question of the utilization of various carbon sources is important for tissues cultured among heterotrophic or semi-heterotrophic conditions (GAUTHERET 1942, WOLF—KAPLAN 1956). Our experimental data indicate that β -indolilacetic acid and 2,4-D essentially influence the choice of which carbon sources can form the substrate of cell respiration and polysaccharide synthesis. According to certain authors only the hexoses are adequate carbon sources (CLELAND 1961). Others hold that the pentoses are also suitable (ROMBERGER—NORTON 1961). In these tissue cultures the synthesis of cell-wall material differs from the entire plant. This might be related to the increased cell-wall plasticity forming the preconditions for hyperhydric growth (ORDIN et al. 1955, PRESTON—HEPTON 1960).

During our experiments we have compared in the presence of the growth-promoting 2,4-D the growth differences originating from endogenous carbohydrate reserves, from the use of glycerine and of pentoses, hexoses and disaccharides. These latter three considerably develop in metabolism (FALUDI et al. 1963, FALUDI—PARÁDI 1964). It became clear that the endogenous carbohydrate reserves themselves assured a rather significant growth. Glucoses and fructose are quite utilizable; among the disaccharides, saccharose and trehalose are but maltose is not. Pentoses are either unutilizable or toxic.

Table 3

Effect of saccharose concentration on the in vitro growth of potato tuber tissue cultures
(Cultures were made in Feb. 1964)

Saccharose concentration %	Tissue weight on the 14th day mg \pm $s_{\bar{x}}$	N.I.
0.0	76 \pm 2.3	3.2
0.5	148 \pm 4.2	5.9
1.0	152 \pm 3.6	6.1
2.0	107 \pm 3.9	4.3
5.0	37 \pm 1.2	1.5

We have examined the optimum concentration of saccharides (Table 3) with special regard to the 1—5 per cent prescribed in the literature (PETRU—ŘETOVSKY 1956, GAUTHERET 1959).

The data of the table show that the use of 0.5—1 per cent saccharose is fully satisfactory for the discussed object. At the same time its use in concentrations greater than 2 per cent definitely hinders growth or may even have a toxic effect.

Effect of the concentration of growth regulators

We have examined the effect of the different concentrations of 2,4—D on the growth of potato tissues. The results are indicated in figure 3.

As it may be seen from figure 3 an appreciable increase first occurs in the 2,4—D 10^{-5} range. In the 10^{-4} M range a rather sharp maximum can be

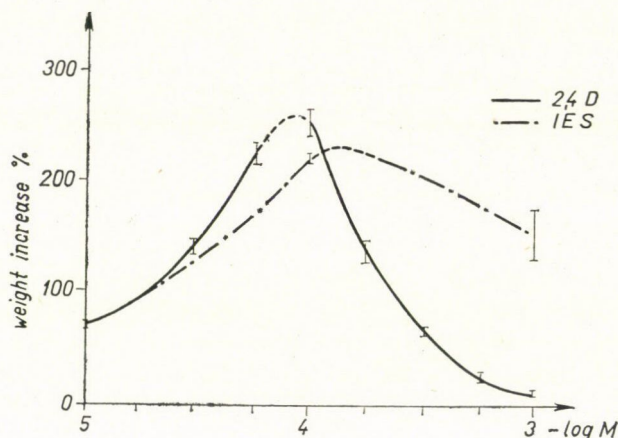


Fig. 3. Effect of various concentrations of 2,4—D and IAA on the weight increase of potato tissue cultures

determined. The increase in concentration by half a measure elicits the same slight increase in growth as the reduction by a whole measure. The use of 10^{-3} M, 2,4—D hinders also endogenous growth.

Using 2,4—D in a 10^{-4} M concentration it resulted in a characteristic hyperhydric elongated growth and definite tumorous swellings on the surface layer already on the 5th day of culture.

Among the 2,4—D analogues, 3,4—D and MCPA prove to have an identical effect, while the mirror image of the latter (CMPA) proves to be ineffective and the 2,5—D was moderately promoting (FALUDI et al. 1965).

Among the hormone-type regulators belonging to different molecular groups, we have examined the β -indolilacetic acid (IAA), 1-naphtil acetic acid

(1-NAA) and 2-naphtoxiacetic acid (2-NOXA). The effect of these compounds on the nature of growth variously differed from that of the 2.4-D (Fig. 4).

The tumorous character of the tissues was less distinct under IAA promotion than in case of 2.4-D. 1-NAA and 2-NOXA induced slight lamination.

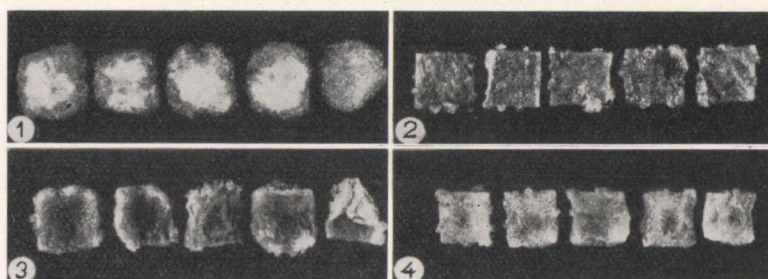


Fig. 4. Growth-promoting effect of various molecular auxins

2.4-D β-IAA
1-NAA 2-NOXA

The differences in the degrees of growth promotion were much more explicit (Table 4). The effect of 1-NAA nearly corresponded to that of 2.4-D, but the effect occurred at a broader concentration zone. Upon the application of IAA the degree of promotion was considerably lower than those of 2.4-D and 1-NAA, especially if we bear in mind the fact that the concentration of IAA was much greater than usual. 2-NOXA proved to be completely ineffective on *Solanum*.

Table 4

Effect of different molecular auxins on the growth
of potato tissues
(Cultures were made in Nov.—Dec. 1963)

Mol.	2.4-D		β-IAA		1-NAA		2-NOXA	
	mg ± s _x	N. I.	mg ± s _x	N. I.	mg ± s _x	N. I.	mg ± s _x	N. I.
0	36 ± 0.38	1.4	31 ± 0.51	1.2	34 ± 0.41	1.4	35 ± 0.73	1.4
10 ⁻⁷	36 ± 0.40	1.4	35 ± 0.69	1.4	34 ± 0.58	1.4	35 ± 0.45	1.2
10 ⁻⁴	139 ± 2.68	5.5	90 ± 1.28	3.6	102 ± 1.28	4.1	52 ± 0.37	1.3
10 ⁻³	28 ± 0.40	1.1	89 ± 2.41	3.5	107 ± 1.87	4.3	55 ± 2.34	1.4

Effect of agar-agar concentration

From data found on other objects in literature, we may conclude that an agar-agar concentration of approximately 1 per cent was chosen but we could not find sources on tests concerning optimum experimental determinations.

The lower limits of concentration are of course determined by the temperature at which the growth medium can achieve a semi-solid state. In our experiments we employed a 0.5—4 per cent series of agar-agar concentrations (Table 5).

Table 5
*Optimal agar-agar concentration for the growth
of potato tissues*
(Cultures made in Dec. 1964)

Agar-agar concentration %	Tissue weight on 14th day mg \pm s _x	N.I.
0.0	76 \pm 2.3	3.2
0.5	148 \pm 4.2	5.9
1.0	152 \pm 3.6	6.1
2.0	107 \pm 3.9	4.3
5.0	37 \pm 1.2	1.5

The data of the Table show that under no circumstances is it advisable to increase the agar-agar concentration to more than 1 per cent because some growth inhibition occurs above 1 per cent which simultaneously has a favourable effect on homogeneity. The 2 per cent agar-agar concentration has, on the other hand, a dangerous inhibitory effect.

Results and Conclusions

Regarding the *Gül Baba* variety of *Solanum tuberosum* L., we have selected a growth medium composition of such controllability and reproducibility that it satisfies even the absolutely necessary semi-heterotrophic requirements of tissue culture of higher plants. We didn't pay special attention to the employment of oligodynamic materials (vitamins, minor elements) among the particular experimental conditions. The significance of the latter may come under consideration when, in case of special characteristics related to the species, the necessary time course for the short-term culture of the species essentially exceeds 14—16 days.

The advantage of selecting accumulating tissues (NOBÉCOURT 1938) was also striking when choosing the object in our experiments. Hyperhydric growth began very early. Similar phenomena were noted only exceptionally in other tissue parts of *Aucuba Japonica* (NYSTERAKIS 1948) and *Tilia americana* L. (BARKER 1957) stem cultures.

The guaranteeing of homogenous growth in addition to weight increase is also a very essential point to remember when choosing the mineral growth medium. We have to attempt to harmonize the two with regard to the fact

that beyond a certain point inhibited growth may also lead to the reduction of variability. For instance HELLER (1953) did not consider this in his extensive studies.

The effect of different ion concentrations may be favourable or unfavourable depending on the purpose of the experiment. Thus for instance the $\text{Ca}^{++}/\text{Mg}^{++}$ proportion of the Gautheret growth medium is disadvantageous especially when considering cell-wall formation when we want to assure undifferentiated growths. Due to the high SO_4 concentration the choice of a Pranyisnyikov growth medium may cause some risk when making more detailed studies of metabolism. The high Na^+ ion concentration of Heller's growth medium was found to be definitely advantageous in the study of tumour formation (BURKHOLDER—NICKELL 1949) while it was less suitable for other tissue cultures (SLABECKA—SZWEYKOVSKA 1952, NITSCH—NITSCH 1956).

The satisfaction of *organic N* requirements by the proper concentration of enzymatic casein hydrolizate is an important assurance of the applicability of short-term cultures, although greater weight increases may be undoubtedly achieved with embryotrophic complexes (coconut milk, corn milk, yeast extracts) containing unknown beneficial material. Its great advantage is that one need not calculate on unknown active ingredients as factors of uncertainty. In our experiments we found a concentration lower than that usual in the literature to be optimum. KENT—BRINK (1947) employed the same concentration for the growth of *Hordeum* embryos. The toxic effect associated to certain amino acids is avoidable with this concentration. The authors, by the way, do not publish data concerning the choice of the higher casein hydrolizates used in their work and they only support the correctness of the percentage distribution (SCHANTZ—STEWART 1955). Others successfully employed amino acid mixtures in proportions approximately agreeing with this (SANDERS—BURKHOLDER 1948).

The external insurance of *carbon sources* is also regarded as indispensable for the culture of assimilating tissues in light. This problem has not yet been clarified (GAUTHERET 1959). We have also experienced significant endogenous growth of tuber tissues grown in the dark. This may be characteristic of the storage tissues. Other data when discussing the amount of external carbon sources refer to the speedy disappearance of starch occurring under the effect of 2,4-D (BOOTHBY—WRIGHT 1962). Since the external carbon source may also be starch (VAN LITH—VROOM et al. 1960) in our view the explanation seems obvious that the building up of polysaccharides does not occur in case of increased hydrolytic processes or rather the storage of polysaccharides becomes disturbed. Thus a uniform supply can be assured only by constant external doses.

Regarding the utilization of carbohydrates we have to pay attention to subtle differences in varieties. This is especially true in case of glycerine

where transglycolization occurs differently from the others, by means of cytidinphosphate (FALUDI et al, 1961, FALUDI 1964).

Concerning the harmful effect of saccharose concentrations higher than 2 per cent, it has been agreed that the phenomenon is specific and unrelated to osmotic effects (STREET—LOWE 1950).

In the tissue cultures of protato tubers the employment of growth-promoters is unavoidable. On the basis of our experiments it can be stated that the nature and degree of growth promoted by auxin have differences depending on the concentration chosen and on the molecular type. Thus an arbitrary interchange of these is impossible. This contradicts those field experiments and laboratory tests according to which only quantitative differences exist between the members of the four chemical groups (KOEFLI et al. 1938, EMERT 1961). This opinion was based on the fact that they could be antagonized in an identical way (BARLOW et al. 1957, HAMILTON 1960). In our view this explanation is inadequate as it only supports the identity of the place affected but not that the manner of action.

The effect of the optimum agar-agar concentration is likely attributed to the formation of the appropriate gel structure which still allows a water uptake. This is supported by the circumstance that inorganic gel also assures proper growth (HELLER 1953). In our experiments we practiced extraordinary cleansing which excluded the influence of impure active agents. Our supposition fits in with the series of examinations showing that the proportion of the ice structure of the water components of agar-agar is closely correlated with the concentration (HECHTER et al. 1960). Thus it is understandable that in greater concentrations the nutrients and probably even to a greater extent the induced water uptake are hindered.

On the basis of what has been presented it can be stated that all the components of the medium have optima which have to be separately determined for every experimental object or variety.

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A STUDY ON THE EFFECTS OF PRE-SOWING SEED TREATMENT OF SOYBEAN (*GLYCINE MAX*) WITH MALEIC HYDRAZIDE

By

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This investigation indicates that a presowing treatment of seeds of soybean with maleic hydrazide may be helpful in getting a better crop of soybean, and that concentrations and durations of treatment are the two important factors in its practical use.

Introduction

Following the important work of SCHOENE—HOFFMANN (1949) in the year 1949, 1, 2-dihydro-3, 6-pyridazine-dione, commonly known as maleic hydrazide, symbolized as MH has been widely tested by workers, in the fields of both agriculture and horticulture. Although it is generally used for its anti-auxinal properties, McILRATH (1950) and some others have shown that it has both growth-promoting and growth-inhibiting properties, depending upon its concentration and other associated factors. Knowing its limited investigation, so far as leguminous crops are concerned, an attempt has been made to study the effects of the compound on soybean (*Glycine max* Merrill).

Materials and Methods

MH-40, a water soluble sodium salt of 1,2-dihydro-3, 6-pyridazine-dione, containing 40 per cent active ingredients by weight, was used in this investigation. The MH solutions were prepared as detailed below:

0.025 gm. of MH-40 dissolved in 1 litre of distilled water =	10 ppm.
0.125 gm. of MH-40 dissolved in 1 litre of distilled water =	50 ppm.
0.625 gm. of MH-40 dissolved in 1 litre of distilled water =	250 ppm.
3.125 gm. of MH-40 dissolved in 1 litre of distilled water =	1250 ppm.

Seeds of the soybean variety, K. 16, had been soaked in the above solutions for three different durations, namely, 12 hours, 24 hours and 36 hours. For each duration, a control set was maintained, the seeds of which were soaked in distilled water. The treated seeds were sown in pots (5 to 6 seeds in each) in 3 replications. There were in all 45 pots, each of which had been filled earlier with a mixture of well-pulverised soil and farm-yard manure in the proportion of 2 : 1. After germination of seeds, thinning was done keeping 2 plants in each pot.

In order to have an idea of the effect of maleic hydrazide on the growth of plants, observations were recorded on various characters, some of which were studied on a number of dates, when the plants were of different ages. One plant in each pot was selected at random for the above study. The various plant characters considered were, height of plant, number of branches, number of leaves, number of opened flowers, number of pods with grain, number of pods without grain, yield of grain, and 100-seed weight.

Experimental Results

The highest concentration, namely, 1250 ppm., was very toxic on germinating seeds, to such an extent so that even with the minimum duration of 12 hours, none of the seedlings survived and hence no observation was possible. Similarly, in the case of 250 ppm. concentration with a duration of 36 hours, seedlings did not survive. However, this treatment had to be taken into consideration (the mean value was taken to be zero) for statistical analysis, since in the case of this concentration (250 ppm.), observations could be recorded for the other two durations, namely, 12 and 24 hours.

Table 1
Average height of plants (cm)

Treatments	Age in days				
	20	40	52	64	76
12 hrs. 0 ppm. (control)	21.16	47.83	60.00	74.33	77.33
12 hrs. 10 ppm.	21.33	47.83	61.83	71.50	81.66
12 hrs. 50 ppm.	22.16	51.83	62.50	68.83	78.50
12 hrs. 250 ppm.	16.33	47.16	57.66	75.00	75.50
24 hrs. 0 ppm. (control)	20.66	48.33	60.00	73.33	77.50
24 hrs. 10 ppm.	21.83	50.66	62.83	74.16	83.83
24 hrs. 50 ppm.	23.66	58.33	67.50	80.16	82.16
24 hrs. 250 ppm.	11.66	35.00	44.33	54.00	62.33
36 hrs. 0 ppm. (control)	20.83	52.50	60.16	73.83	79.00
36 hrs. 10 ppm.	23.33	59.83	72.50	87.00	87.83
36 hrs. 50 ppm.	23.50	58.50	75.33	84.16	84.50
36 hrs. 250 ppm.	0	0	0	0	0
C. D. at 5% level	2.84	6.67	6.77	11.09	8.67

The treatment differences were, as may be seen above, highly significant at all stages of growth. From the nature of the growth curves in Fig. 1 (a, b, c), it will appear that all concentrations at 12 hours' duration have little or no effect on the height of plant. In the case of the treatment with 50 ppm. concentration for 24 hours, the plant height at two stages, viz., 40 and 52 days, was much higher than in other concentrations of the same duration, but as the plant approached maturity, it did not behave in the same way. A much adverse effect was noticed under the same duration with a concentration of 250 ppm. Stimulating effect at all stages, however, was found with 10 ppm. concentration with 36 hours' duration.

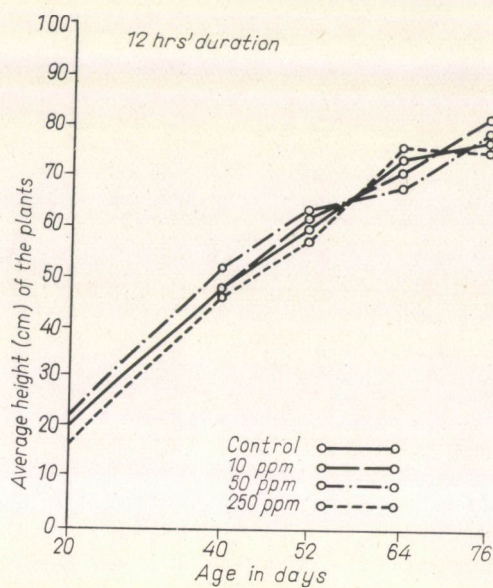


Fig. 1a

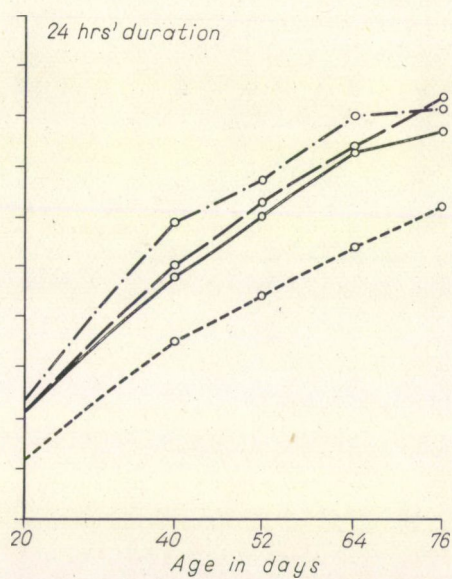


Fig. 1b

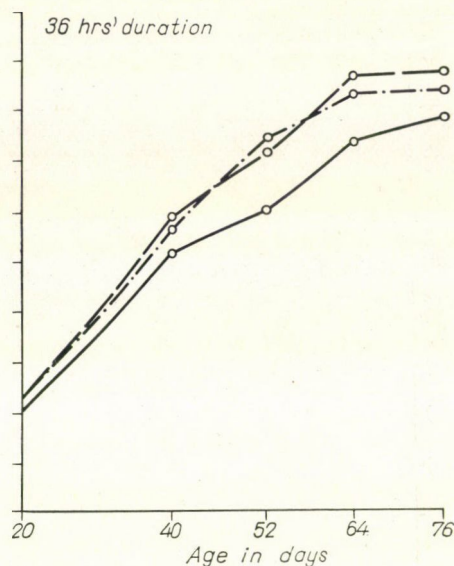


Fig. 1c

Fig. 1. Average height of the plants at successive stages of growth following seed treatment for three durations, viz., 12 hrs. (1a), 24 hrs. (1b) and 36 hrs. (1c)

The data for branch number (Table 2) indicated that there were significant differences within the durations and also within the concentrations. The interaction between duration and concentration was also found to be highly significant. This implied that the concentrations did not behave similarly at all durations and vice versa. Among durations, 12 and 24 hours did

Table 2

Average number of branches per plant

Concentration (ppm.) (duration [hrs.]) ↓	0	10	50	250	Mean	C. D. for duration at 5% level.
12	8.33	7.33	11.00	9.33	8.99	1.08
24	8.33	9.00	11.00	8.00	9.08	
36	8.33	10.00	8.66	0	6.75	
Mean	8.33	8.77	10.22	5.77		

C. D. for concentration at 5% level 1.25

C. D. for comparison of means inside the Table at 5% level 2.16

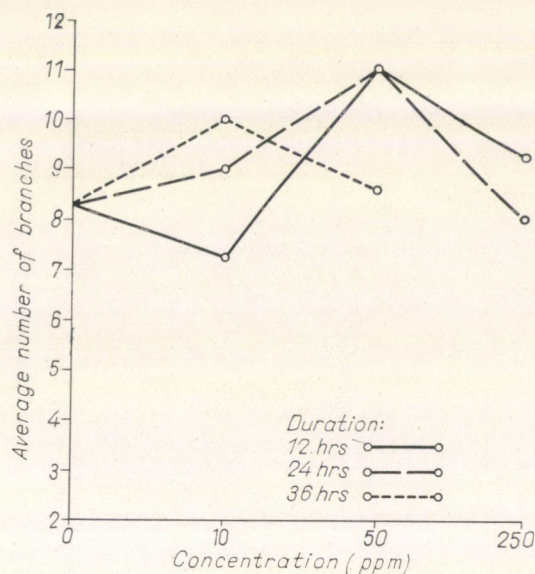


Fig. 2. Average number of branches per plant following seed treatment for three durations

not show any significant difference, while both of them differed significantly from 36 hours. 0 and 10 ppm. concentrations did not show significant difference among themselves, but each of them differed significantly from 50 and

Table 3
Average number of leaves per plant

Treatments	Age in days			
	22	42	62	72
12 hrs. 0 ppm. (control)	6.00	19.00	38.33	30.33
12 hrs. 10 ppm.	5.00	20.66	47.66	23.33
12 hrs. 50 ppm.	3.66	21.66	60.00	52.33
12 hrs. 250 ppm.	3.00	21.33	62.00	60.00
24 hrs. 0 ppm. (control)	5.33	20.33	37.33	32.00
24 hrs. 10 ppm.	4.00	21.33	49.66	25.00
24 hrs. 50 ppm.	4.33	23.66	56.33	44.33
24 hrs. 250 ppm.	2.00	11.00	32.66	50.00
36 hrs. 0 ppm. (control)	4.33	20.33	38.00	33.00
36 hrs. 10 ppm.	4.33	22.00	51.66	38.00
36 hrs. 50 ppm.	4.33	23.66	58.00	43.66
36 hrs. 250 ppm.	0	0	0	0
C. D. at 5% level	0.97	4.00	7.37	9.80

250 ppm. concentrations. The maximum mean value was, as may be seen, obtained with 50 ppm. concentration.

The influence of maleic hydrazide on branch number is shown graphically in Fig. 2. A concentration of 50 ppm. of either 12 hours' or 24 hours' duration produced maximum number of branches. In all other cases, little or no response was observed.

The treatment differences were highly significant at all stages of growth. A scrutiny of the above data and the graphical representation in Fig 3 (a, b, c) reveal that the number of green leaves increased for some time with the age of plant and then it decreased. This decrease was due to the gradual drying up of leaves with the advance of maturity of the plants. In the earlier stages of plant growth, particularly at 22 days, there was a depressing effect of the growth regulating substance. The position, however, changed with an increase in age of plants, when a stimulating effect was observed. This stimulating effect was found to be associated with lighter concentrations (10 and 50 ppm.). With higher concentration also (250 ppm.), this effect was observed when the duration was short (12 hrs.). 250 ppm. at 24 hours' duration produced significant toxic effects on leaf number, particularly in the early stages of plant growth, but the number of leaves gradually increased and, at the last stage, it was considerably higher than in the control.

The data on number of flowers (Table 4) indicate that the treatments differed significantly at all stages of growth.

The curves in Fig. 4 (a, b, c) bring out an interesting feature of the response of flowering to different treatments. In the case of control plants, the

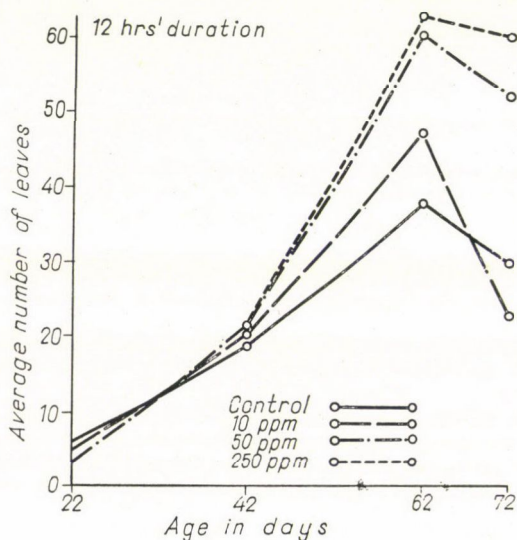


Fig. 3a

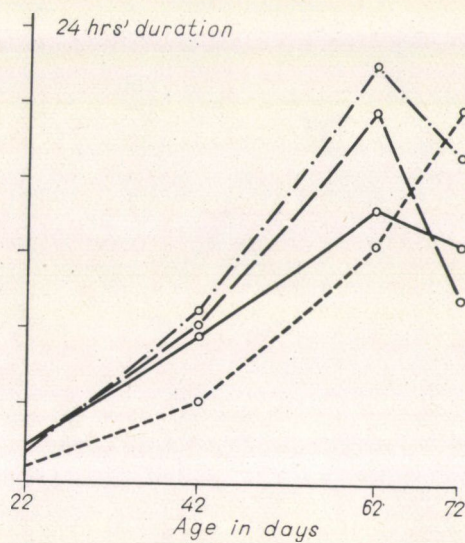


Fig. 3b

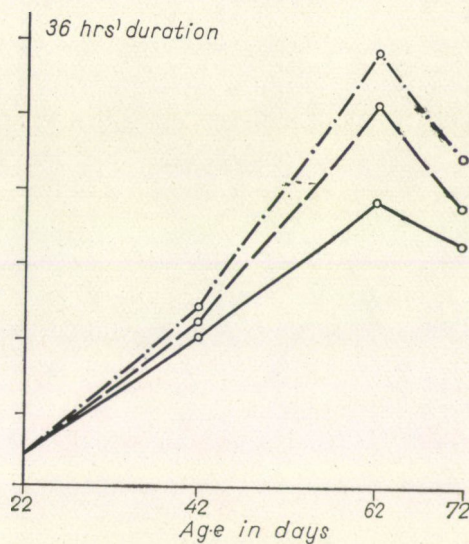


Fig. 3c

Fig. 3. Average number of leaves per plant at successive stages of growth following seed treatment for three durations, viz., 12 hrs. (3a), 24 hrs. (3b) and 36 hrs. (3c)

Table 4
Average number of flowers per plant

Treatments	Age in days				
	51	54	57	61	65
12 hrs. 0 ppm. (control)	21.66	48.00	26.33	26.33	15.00
12 hrs. 10 ppm.	24.33	50.00	30.00	50.00	24.66
12 hrs. 50 ppm.	18.66	48.66	24.33	38.33	22.33
12 hrs. 250 ppm.	17.00	44.33	22.00	44.00	25.33
24 hrs. 0 ppm. (control)	22.66	46.33	25.66	26.33	15.33
24 hrs. 10 ppm.	25.33	49.00	22.66	40.33	20.00
24 hrs. 50 ppm.	21.33	40.00	18.66	28.00	19.00
24 hrs. 250 ppm.	0	6.00	11.00	44.00	14.00
36 hrs. 0 ppm. (control)	20.66	45.00	25.00	25.66	13.66
36 hrs. 10 ppm.	27.00	50.00	12.66	25.66	18.00
36 hrs. 50 ppm.	23.33	42.00	12.00	27.00	19.00
36 hrs. 250 ppm.	0	0	0	0	0
C. D. at 5% level	10.05	14.40	9.97	9.80	12.01

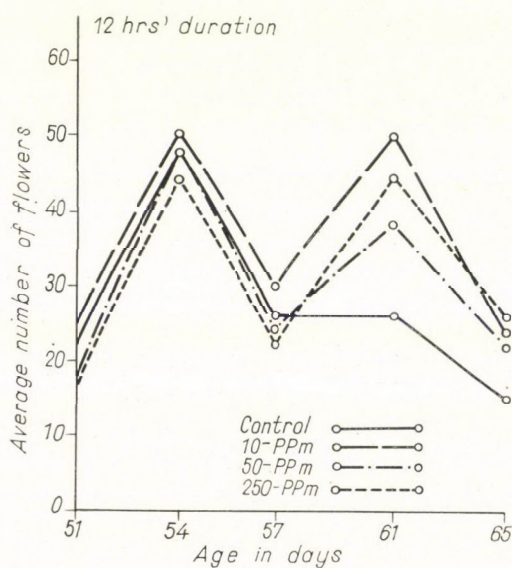


Fig. 4a

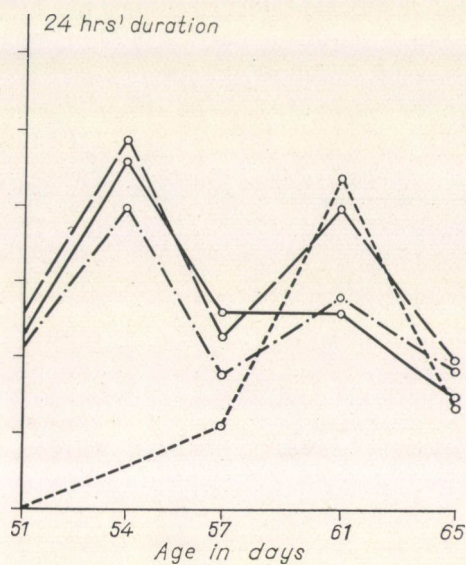


Fig. 4b

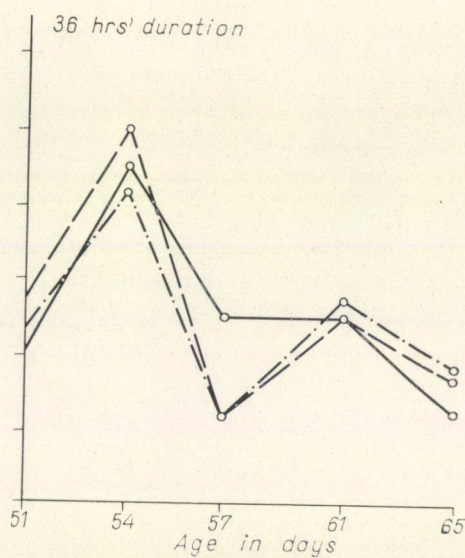


Fig. 4c

Fig. 4. Average number of flowers per plant at successive stages of flowering following seed treatment for three durations, viz., 12 hrs. (4a), 24 hrs. (4b) and 36 hrs. (4c)

curve shows only one peak at the age of 54 days, while in all the treated series, a second flush of flowers was also observed, except in the case of 250 ppm. concentration at 24 hours' duration (in which flowering was much delayed and only one peak was observed at 61 days).

Table 5
Average number of pods per plant

Concentration (ppm.) / Duration (hrs.) → ↓	0	10	50	250	Mean	C. D. for duration at 5% level.
12	109.33	153.70	222.33	208.33	173.42	17.61
24	108.33	178.00	164.70	93.00	136.01	
36	109.33	159.33	126.67	0	98.83	
Mean	108.99	163.67	171.23	100.44		

C. D. for concentration at 5% level 20.33

C. D. for comparison of means inside the Table at 5% level 35.21

Number of pods per plant presented in Table 5 indicate that the three durations differed among themselves significantly. So far as the concentrations were concerned, 10 and 50 ppm. differed significantly from 0 and 250 ppm. The interaction between duration and concentration was also significant as was observed in the case of number of branches. The maximum number of pods was obtained at 12 hours' duration and the minimum at 36 hours'. With an increase in duration, there was a sharp fall in pod number.

As may be seen from the curves in Fig. 5, 10 and 50 ppm. concentrations were always stimulative regardless of durations. Heavier dose of 250 ppm., when used for a short period of 12 hours, was found to be helpful in stimulating pod number. The maximum number of pods (222.33), however, was found in the case of 50 ppm. concentration with 12 hours' duration.

There were significant differences between durations as well between concentrations (Table 6). Durations of 12 and 36 hours, however, did not show any significant difference within themselves, but each of them varied significantly from 24 hours. Among concentrations, 0, 10 and 50 ppm. did not show any difference among themselves, while all of them differed significantly from 250 ppm.

It will appear from Fig. 6, that the minimum number of empty pods was obtained in the cases of 10 and 50 ppm. concentrations at 12 hours' duration. 250 ppm. concentration at 24 hours' duration gave the highest number of empty pods (10.66).

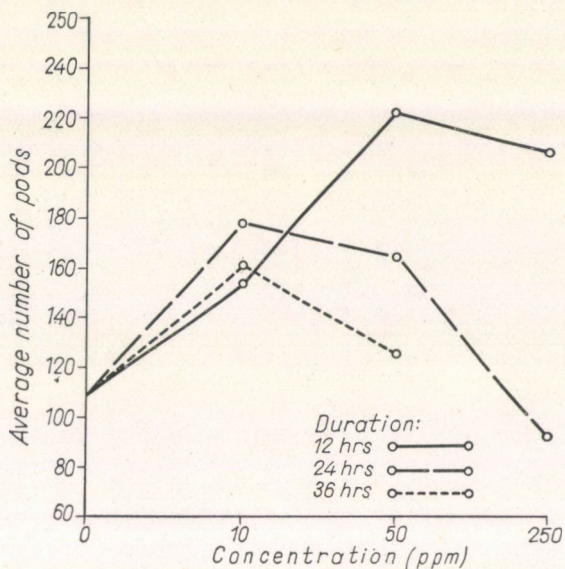


Fig. 5. Average number of pods per plant following seed treatment for three duration

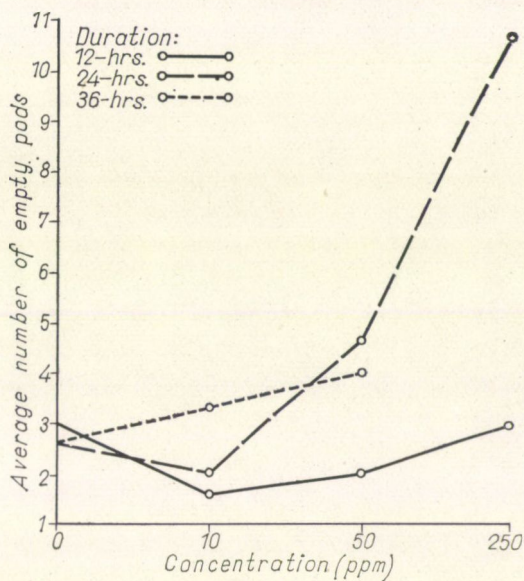


Fig. 6. Average number of empty pods per plant following seed treatment for three durations

As was seen in the case of pod number (Table 5), significant differences were observed in this case also (Table 7), in concentrations as well as in durations. A duration of 12 hours gave the maximum mean yield, followed by 24 hours and 36 hours, in that order. As regards concentration, 0 and 250 did

Table 6
Average number of empty pods per plant

Concentration (ppm.) → Duration (hrs.) ↓	0	10	50	250	Mean	C. D. for duration at 5% level.
12	3.00	1.66	2.00	3.00	2.41	1.03
24	2.66	2.00	4.66	10.66	4.99	
36	2.66	3.33	4.00	0	2.49	
Mean	2.77	2.33	2.66	4.55		

C. D. for concentration at 5% level 1.19

C. D. for comparison of means inside the Table at 5% level 2.06

Table 7
Average single-plant yield (gm.)

Concentration (ppm.) → Duration (hrs.) ↓	0	10	50	250	Mean	C. D. for duration at 5% level.
12	25.22	31.83	59.60	54.27	42.73	5.51
24	24.45	35.97	42.98	18.38	30.44	
36	24.44	33.00	30.65	0	22.02	
Mean	24.70	33.60	44.41	24.22		

C. D. for concentration at 5% level 6.21

C. D. for comparison of means inside the Table at 5% level 10.77

not show any difference among themselves, but each of them varied significantly from 10 and 50. The highest mean yield was recorded in the case of 50 ppm. The interaction between duration and concentration was also highly significant. This showed that the durations did not differ similarly in the case of the different concentrations and *vice versa*.

It will be evident from Fig. 7, that 12 hours' duration with 50 and 250 ppm. concentrations recorded the maximum singleplant yields of 59.60 gm. and 54.27 gm., respectively. The next best response was observed in the cases of 10 and 50 ppm. at 24 hours' duration.

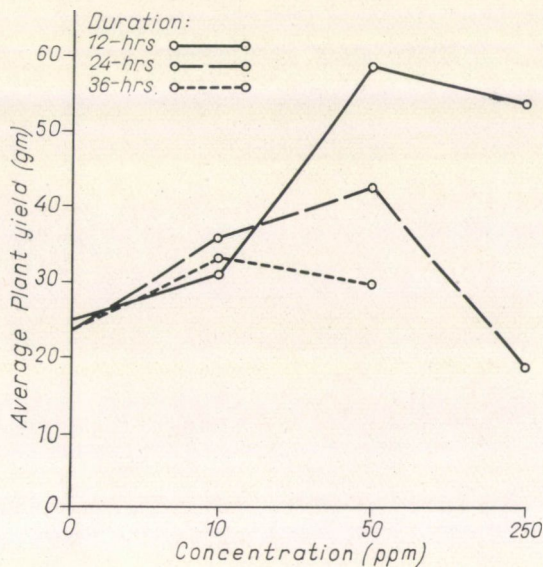


Fig. 7. Average yield of grain per plant following seed treatment for three durations

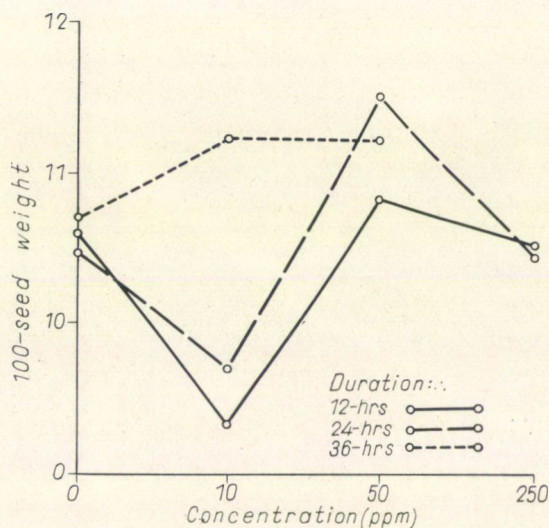


Fig. 8. Average weight of one hundred seeds following seed treatment for three durations

As regards durations, 12 and 24 hours did not show differences among themselves, but each of them differed significantly from 36 hours. So far as concentrations were concerned, there were significant differences among all the four, the maximum mean value being obtained in the case of 50 ppm.

Table 8
Average weight of one hundred seed (gm.)

Concentration (ppm.) → Duration (hrs.) ↓	0	10	50	250	Mean	C. D. for duration at 5% level.
12	10.62	9.39	10.86	10.55	10.35	0.42
24	10.49	9.66	11.45	10.51	10.53	
36	10.72	11.27	11.23	0	8.30	
Mean	10.61	10.10	11.18	7.02		

C. D. for concentration at 5% level 0.46

C. D. for comparison of means inside the Table at 5% level 0.83

As may be seen in Fig. 8, 50 ppm. concentration at 24 hours' duration gave the maximum seed weight, and the minimum was obtained from 10 ppm. concentration treated for 12 hours.

Discussion

The response of soybean plants was studied in relation to presowing seed treatment with maleic hydrazide. A number of morphological changes was observed. In certain cases, there was growth stimulation, while in others growth retardation, and in still others, the effectiveness of treatments was found to be insignificant.

Besides the final yield of grain, some of the yield attributes were also studied. 50 ppm. concentration at 12 and 24 hours' durations stimulated the production of branches and increased their number considerably, while 250 ppm. concentration at 12 hours' duration, and 10 ppm. concentration at 24 hours' duration affected the number of branches less favourably. SAXENA *et al.* (1965) also observed stimulating effect on branch number in *Brassica campestris*, when plants were sprayed with maleic hydrazide of 500 and 1000 ppm. concentrations. In the present investigation, the different concentrations which encouraged the production of branches did not show any appreciable effect on plant height. The compound probably served as a stimulus only in the development of axillary buds.

The treatments had much influence on the number of leaves. All the lighter concentrations produced stimulating effects on leaf number, particularly at the age of 62 days, and in most cases, 72 days also. The increase in leaf number, at the ages mentioned, indicated that almost till the end, these

plants maintained a good deal of vigour in contrast to the control. This is likely to have helped the plants in question with synthesising a larger amount of food material. CHOUDHRI—BHATNAGAR (1955) also observed a greater number of immature leaves in the treated plants.

An interesting feature was observed in respect of flowering behaviour. While control plants showed only one peak of flowering, the treated ones in general showed two. This will be evident from Table 4 and Fig. 4. The control plants and the treated plants in question followed the same trend of flowering up to the age of 57 days, when there was a decline in the number of flowers. The treated series, however, produced another flush of flowers in sharp contrast to the control plants, which remained stationary for a considerable length of time and then registered a fall. It has been observed that in the treated series, the number of leaves increased considerably when the plants were fairly advanced in age, and this may have been responsible for the synthesis of the necessary food and maintenance of its supply at that time. Further, the treatments in question, were probably effective in stimulating the production of flowering hormone in the plants at this age, and the hormone may have, in its turn, helped with producing the second flush of flowers.

50 and 250 ppm. concentrations at 12 hours' duration and 10 and 50 ppm. concentrations at 24 hours' duration were found to enhance both pod number and yield of grain. The latter was unaffected by all other treatments. This increase in pod number was expected since flower production had been favoured by the treatments in question. As was natural, single-plant yield was very much dependent on the number of pods. It has appeared that the treatments that stimulated the production of pods, increased the grain yield correspondingly.

50 ppm. concentration at 24 hours' duration gave a higher grain yield than 10 ppm. concentration at the same duration although number of pods was higher in the latter treatment. The former treatment, on the other hand, produced heavier seeds, as is evident from 100-grain weights (Table 8 and Fig. 8) and this might have influenced the yield of grain.

The toxic effects of maleic hydrazide on seeds of soybean were also evident in this investigation. Strong concentrations were harmful to most of the morphological characters. 1250 ppm. concentration at all the durations and 250 ppm. concentration at 36 hours' duration were so much toxic that seedling survival was absolutely nil. 250 ppm. concentration at 24 hours' duration adversely affected various characters, viz., height of plant, number of leaves, number of pods, and ultimately, the yield of grain. Further, this treatment increased the production of empty pods. According to GREULACH *et al* (1953, 1954), MH at higher concentrations had antimitotic properties and did inhibit the elongation of the younger internodes by inhibiting cell division. In the present investigation, no striking morphological abnormality was observed.

WATSON (1952) did not find any abnormality in cell-division, while ZUKEL (1956) found adverse effects of the treatments on growth hormone. Whatever might be the mechanism of action of MH on plant growth, the observations made by MC ILRATH (1950) seem to indicate that the substance possessed both growth-promoting and growth-inhibiting properties. The results obtained in the present investigation also support this view.

Conclusion

An investigation has been taken up to study the effects of presowing seed treatment of soybean variety, K.16, with maleichydrazide. Four concentrations, viz., 10, 50, 250 and 1250 ppm., and three durations, viz., 12, 24 and 36 hours have been used. With 1250 ppm. concentration, none of the seedlings survived. Similar was the case with 250 ppm. concentration at 36 hours' duration. So far as the other concentrations were concerned, the following results were obtained.

Most of the concentrations of MH have little or no effect on plant height, while a strong dose of 250 ppm. used for 24 hours, had a retarding effect.

Number of branches was increased by 50 ppm. concentration, when used either for 12 hours or 24 hours.

Almost all the lighter concentrations of MH stimulated the production of number of leaves.

Lighter concentrations of MH produced two flushes of flowers, while the control produced only one. The concentration of 250 ppm. at 24 hours' duration, however, delayed the flowering.

Number of pods increased considerably in the case of 50 and 250 ppm. concentrations at 12 hours' duration, which were followed by 50 and 10 ppm. concentrations at 24 hours.

A large number of empty pods (seedless) was observed with high concentrations, viz., 250 ppm. at 24 hours' duration.

Single plant yield was affected considerably by the treatments. Lower concentrations in general, had stimulating effect, while higher concentrations were very much toxic. As in the case of pods, 50 and 250 ppm. concentrations at 12 hours' duration proved to be the best. The next best response was observed in the cases of 50 and 10 ppm. concentrations at 24 hours' duration.

Acknowledgement

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HOW THE CHANGES IN NPK CONTENT OF PLANTS REFLECT MINERAL NUTRITION AMONG NORMAL CIRCUMSTANCES

By

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According to the study the concentration of nutrients in the plant tissues does not change gradually but in leaps even when the external mineral supply gradually increases. This change was examined by the authors in seedlings of *Sinapsis alba*. Due to its simplicity this plant is suitable for solving the problem. The discussion of the above question is important in addition to its general biological aspects for determining the degree to which nutrient materials are supplied to the plants.

Introduction

The key problem of plant analysis is the relation between external and internal nutrient concentrations. BERNARD PALISSY (1500—1589) had studied already the question in his work „*Les sels végétatifs*”. He proved that the salt in the ash of plants originated from the soil and thus he preceded by almost three centuries the epoch-marking work of JUSTUS LIEBIG (1803—1873) who first published his „*Die Chemie in ihrer Anwendung auf Agricultur und Physiologie*” in 1840. As it is commonly known this work expressed the idea of replacement with ashes. Two decades later WEINHOLD (1862) was trying to deduce from the chemical composition of plants the extent to which plants are supplied with nutritive elements. And HELLRIEGEL (1867) even pointed out that the absorbable concentrations of potassium are found in definite proportions in the ash of the plant. Then a multitude of plant analytic studies were published in the literature (see FRENÝÓ's dissertation, 1965) which proves that the amount of artificial fertilizers and in general the degree of external nutrient supplies cause changes in the internal structure of the plant. The laws of this change are, however, not clearly explained. The adherents of the different views agree that there is — generally speaking — a positive correlation between external and internal concentrations of absorbable nutritive elements. They also agree that the internal concentration certainly progresses toward a limit when following the increase of mineral nutrition. Thus it would be correct to suppose that we are concerned with one of the versions of MITSCHERLICH's law and the course of changes in internal concentration in relation to external mineral supply can be expressed by the following formula:

$$\frac{dy}{dx} = c(A - y)$$

in which dx represents the external and dy the internal changes in concentration, A is the maximum yield and c the corresponding coefficient. Thus it is possible to suppose an infinitesimal relation between external and internal concentration.

FRENÝÓ in his mentioned work (1965) notes that this relation has rather a „quantum” character, i.e., the concentration follows external changes, not gradually but by leaps and bounds. He holds that fundamental biological laws are manifest in this phenomenon. The living organism is to a certain extent resistant to environmental changes and thus external concentration must first reach a point sufficient for overcoming internal resistance and then the internal concentration increases by a leap towards a new limit.

The purpose of our present work is to support this observation by further experiments.

Experimental Procedure

Various plants were used for the experiment. Nevertheless here we will not discuss the data gained from the morphologically very differentiated specimens. Only the data on the simplest experimental material, the 9-day old *Sinapsis alba* seedlings will be introduced with the comment that similar results have been gained from more complex cases.

From the 4th day of sprouting the seedlings were grown in increasing or decreasing concentrations of Knop nutrient solution according to a consecutive series. The series was as follows: $4 \times$, $2 \times$, $1 \times$, $\frac{1}{2} \times$, $\frac{1}{4} \times$ KNOP solution or tapwater. The plants were grown in a small growth chamber with a lighting of 3.500 lux and at room temperature. The aerial portion of the 9-day old plants were cut off, dried at 60°C ; they were first analyzed with FRENÝÓ's method (1962). One data is the mean value of 35—40 plants.

Results and Discussion

The changes in the concentration of nutritive elements examined in the dry-matter of white mustard seedlings will be separately treated as follows:

1. *Nitrogen fractions.* The ammonium and nitrate extrated from the dry-matter of the plants by together form the most important inorganic constituents of nitrogen compounds. Fig. 1 shows that if the concentration of KNOP solution is increased, the combined concentration increases approximately four-fold. Between the two components only the change in the nitrate is considerable. Regardless of the extent to which the amount of mineral nutrients in increased, the ammonium content remains almost unaltered. Moreover the ammonium concentration was even decreased when the plants were grown not in water but in a $\frac{1}{2}$ of $\frac{1}{4}$ KNOP solution.

The increase in the concentration of inorganic nitrogen as well as that of the nitrate proceeds by leaps. This leap is especially great when the single concentration of KNOP solution is doubled. But here we come to a limit: for when the concentration of the concentration of the solution is quadrupled the inorganic nitrogen concentration of the dry-matter of the plant does not increase. The course of the increase of concentration forms a sigmoid curve.

It is possible that intervening concentrations would have appeared between the leap-like transitions had the KNOP solution been added more gradually instead of in a geometric progression. Even in this case the quantum relation is more likely than the infinitesimal one. At most, concentration leaps will be smaller when gradually increasing the mineral nutrients.

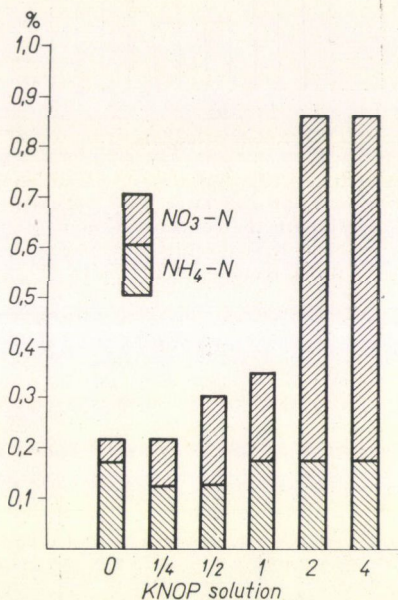


Fig. 1. Among the components of inorganic nitrogen, the nitrate in the tissues of the plant increases to a much greater extent than does the ammonium if the concentration of the KNOP solution is increased. The change is leap-like but follows a sigmoid curve

The nitrogen which cannot be extracted by hot water was mainly fixed in proteins. The nitrogen of simple proteins soluble in cold water or saline solutions can also be found in this fraction: they become insoluble at the temperature of the water bath because of coagulation and only the addition of vitron can release the nitrogen content.

The changes of nitrogen (indicated in Fig. 2) originating mainly from protein are at the beginning characterized by leap-like reduction (0–1/2 KNOP), and then by a leap-like return (1–2 KNOP) which remains unaltered even by the quadruple concentration of KNOP solution. No further essential change in concentration can be expected in the fraction closely belonging to the protoplasm. This fraction, according to figure 2, fluctuates between the limits of approximately 1.4% and 2.8%. While the inorganic nitrate supply can almost entirely disappear from the plant or substantially increase in it, the substance of the live protoplasm — in a determined volume — is incapable of such fluctuation.

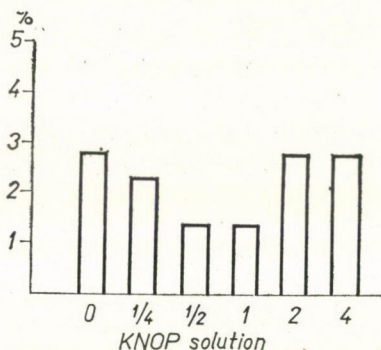


Fig. 2. The nitrogen insoluble during the hot-water extraction is mostly a constituent of protoplasm. Therefore its concentration can alter only between certain limits. Overfeeding (in $2\times$ or $4\times$ KNOP) does not increase the concentration of N belonging to the structure in relation to the plants grown without KNOP solution (0 variant). Reduction is possible only until certain lower limits

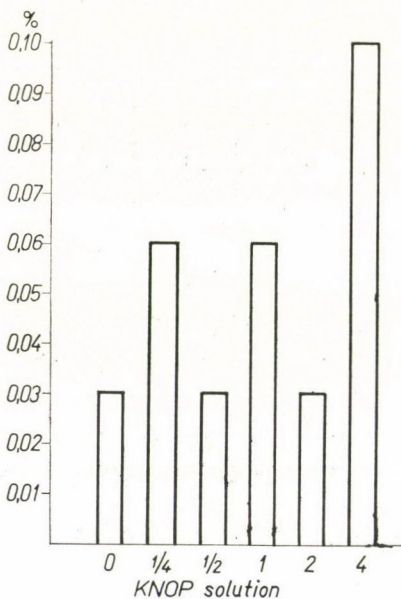


Fig. 3. Changes in the concentration of phosphorous origin

2. *Inorganic phosphorus fraction.* This fraction is practically composed of phosphate the concentration changes of which computed for the phosphorous element are shown in Fig. 3. The concentration fluctuates with repeated alternations between 0.03% and 0.06%, until the concentration of the KNOP solution is quadrupled. Then the intrinsic $\text{PO}_4\text{—P}$ concentration leaps to c. 0.10%. This process does not surely follow a sigmoid curve but only changes appearing in quantum. Among the possible objections the change into an organic fraction

could be regarded as a point in the explanation of the course of concentration occurring in leaps. Thus it is imaginable that the total P concentration increases gradually and only the distribution of fractions changes by leaps. This part of the question requires additional study.

3. *Changes in potassium concentration.* In case of potassium the problem is not complicated by distribution into fractions and not even by the strong

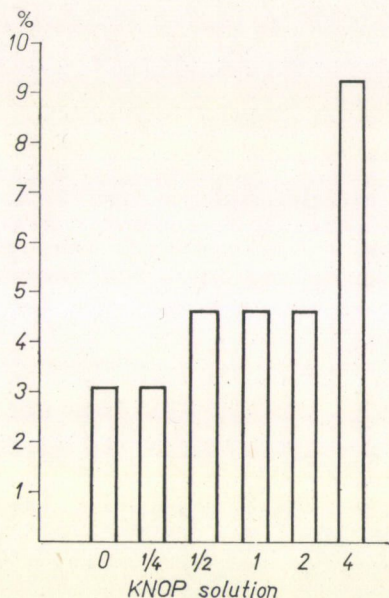


Fig. 4. The changes in the concentration of potassium as the function of the mineral nutrition. The interconnection is not infinitesimal, but quantum

tendency to be incorporated into mitochondria (MENGEL, 1961) because the extraction with the water bath dissolves the entire quantity of potassium from the plant. Thus the decisive data is provided by potassium on whether infinitesimal or quantum relations exist between the external and internal concentration. We get a perfectly unambiguous answer from figure 4 which shows that the 1/4 concentration of KNOP solution does not alter the potassium content of the control (0 variant) grown in water. The next step (1/2 KNOP) increases the internal K concentration in a leap by 50%. Then it remains at this level until the mineral nutrients increase 8 fold (4 KNOP), then the K concentration by another considerable leap increases 100% (in comparison to the previous concentration) in the dry-matter of *Sinapis* seedlings.

Conclusion

The introduced material and especially the changing course of the potassium concentration prove the hypothesis that the mathematical relation between the degree of mineral nutrition and the internal concentrations of nutrients is not infinitesimal. The plant does not react to external changes gradually, but in leap-like (quantum) changes of the internal concentration.

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SOLANUM MELONGENA L. × SOLANUM GILO RADDI HYBRIDS

By

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Crossings have been made between two varieties of *S. melongena* L., namely the Common purple egg-plant and the Common white egg-plant and the *S. gilo* Raddi in order to produce inter-species hybrids. Our crossings proved to be successful only if as mother-plant *S. melongena* L., while as pollinator *S. gilo* Raddi were used. In reversed case no interspecies hybrids could be obtained. The produced hybrids display the properties of both parents, however, the characteristics of *S. gilo* Raddi are more dominating in them.

Introduction

According to literary data, in the family *Solanaceae* L. efficient inter-generic crossings could be achieved with two genera. POGLIAGA (1953) produced an inter-generic hybrid between *Nicotiana tabacum* L. and *Petunia parodii*; ALPATYEV—JURJEVA (1960) carried out successful crossing between the varieties *Lycopersicon esculentum* Mill. and *Cyphomandra betacea* (Cav.) Sendt. Within the genus *Solanum* L. several efficient inter-specific crossings are known. In the majority of these inter-specific crossings one parent is a culture plant as the good properties of another, a wild plant are always in view to carry over, by way of crossing, into the culture plant. Within the *Solanum* L. the most inter-species crossings can be found with the species *Solanum tuberosum* L. (MÁNDY, 1963, 1964). Both the direct and the reciprocal crossing of *S. tuberosum* L. with the species *S. chacoense* Bitt., *S. acaule* Bitt., *S. demissum* Lindl., *S. semidemissum* Juz., *S. stoloniferum* Schlechtd have been successful. According to MÁNDY crossing was also efficient in cases when as mother-plant *S. tuberosum* L., while as pollinator *S. colombianum* Dun. and *S. verrucosum* Schlechtd. were used. When *S. tuberosum* L. was the pollinator plant, inter-specific hybrids were obtained provided that as mother-plant the following species were availed: *S. commersonii* (3×) Dun., *S. edinense* Berth., *S. phureja* Juz. et Buk., *S. maglia* (3×) Schlechtd., *S. vernei* Bitt. et Wittm., *S. vallis-mexici* Juz., *S. chaucha* Juz. et Buk., *S. jamesii* Torr., *S. sucrense* Hawkes, *S. ajanhuiri* Juz. et Buk., *S. goniocalyx* Juz. et Buk., *S. curtilobum* Juz. et Buk., *S. sparsipilum* (Bitt.) Juz. et Buk. Concerning the egg-plant *S. melongena* L., its crossing only with *S. integrifolium* L. is known.

Materials and Methods

One plant of our investigations was the egg-plant *S. melongena* L. while the other was *S. gilo* Raddi. Within the species *S. melongena* L., according to Filov's system (1958) the following two varieties were used: *S. melongena* L. ssp. occidentale Haz. var. *bulgaricum* Fil. Common purple egg-plant variety and *S. melongena* L. ssp. subspontaneum Fil. var. *leucoum* Alef. Common white egg-plant variety.

Of the Common purple egg-plant variety — in the Tables: S. m. (p) — it is characteristic that the stem under the cotyledon (*hypocotyl*) is purple; and so are the young shoots. The colour of the leaf-blade (*lamina*) is dark green; the nervure (*nervatio*) and the bristles (*acaulus*) on the nervure of the leaf are also purple. The peak (*apex*) of the leaf-blade is pointed; the colour of the bristles on the sepal (*sepala*) as well as that of the petals (*petala*) are purple. The fruit (*fructus*) is pear-formed or ellipsoid-shaped; the outer skin of the fruit (*exocarpium*) is purple, the inside skin (*mesocarpium*) is green. Fruits are large, when ripe for consumption they are purple, when thoroughly mature, they are brown.

The Common white egg-plant — in the Tables: S. m. (w) — is characterized by the hypocotyl being green; the young shoots and the leaf-blade are greyish-yellow. The apex of the leaf-blade is pointed, the bristles of the sepals are green, while the petals are purple. The form of the fruit is egg-shaped (*ovatum*), the exocarpium and the mesocarpium are white, the fruit is small, when ripe for consumption, they are white, when thoroughly matured, they are yellowish.

The colour of the hypocotyl of *S. gilo* Raddi — in the Tables: S. g. — is green; the young shoots and the leaf-blades are light green, the nervure of the leaf is green; there are no bristles on the nervure. The apex of the leaf-blade is pointed, on the sepals no bristles can be found; the petals are white. The fruit is flat-round, the exocarpium being red while the mesocarpium is white. Fruit are small, and green while young, in the state of entire maturation they are red with green stripes.

Crossings were performed with plants grown in the field. The flowers used for crossing were in bud-state. These buds had been castrated with pincers before the anthers got ripe. This was followed by isolation and then, after a few days, they were pollinated with freshly gathered pollen. The entire fruit development occurred under isolater.

The produced hybrid seeds were sown next year and the properties for the F_1 generation were examined. Our problems were the following:

1. Is it possible to produce fertile inter-species hybrids between the species *S. melongena* L. and *S. gilo* Raddi?

2. In what manner do the properties of parents appear in the inter-species hybrids that have been produced?

Results

The results of our hybridization work performed between *S. melongena* L. and *S. gilo* Raddi might be divided into two parts. In the first part we write about the producing of *S. melongena* L. \times *S. gilo* Raddi hybrids, while in the second about the properties of inter-species hybrids.

1. The producing of *S. melongena* L \times *S. gilo* Raddi hybrids

In 1962 and 1963 we performed direct and reciprocal crossings between two varieties of *S. melongena* L. viz., the Common purple egg-plant — S. m. (p)-, the Common white egg-plant — S. m. (w) — and the *S. gilo* Raddi — S. g. The results of our crossings carried out in the two years are shown in Tables 1 and 2.

a) *S. melongena* L. \times *S. gilo* Raddi crossings.

When applying as mother plant any of the varieties of *S. melongena* L. used by us, the crossings will be efficient. In both years we obtained quite a

Table 1

Solanum melongena L. and *Solanum gilo* Raddi crossings
1962

Combinations	S. m. (p) × S. g.	S. m. (w) × S. g.	S. g. × S. m. (p)	S. g. × S. m. (w)
Number of crossed flowers	10	10	10	10
Number of set flowers	6	4	—	—
Number of fruits with seeds	3	4	—	—
Average number of seeds in the fruits.....	48.3	225.7	—	—

S. m. (p) = Common purple egg-plant
 S. m. (w) = Common white egg-plant
 S. g. = *Solanum gilo* Raddi

Table 2

Solanum melongena L. and *Solanum gilo* Raddi crossings
1963

Combinations	S. m. (p) × S. g.	S. m. (w) × S. g.	S. g. × S. m. (p)	S. g. × S. m. (w)
Number of crossed flowers	10	10	—	—
Number of flowers set	2	3	—	—
Number of fruit with seeds.....	1	3	—	—
Average number of seeds in the fruit	550.0	105.6	—	—

S. m. (p) = Common purple egg-plant
 S. m. (w) = Common white egg-plant
 S. g. = *Solanum gilo* Raddi

large quantity of hybrid seeds so that the value of the seed setting percentage was rather considerable. The average number of seeds containing viable embryos in one fruit was, when using as mother-plant Common purple egg-plant, 48.3 in 1962 and 550.0 in 1963. On using Common white egg-plant as mother-plant, the average number of seeds containing viable embryos was 225.7 in 1962 and 105.6 in 1963.

b) *S. gilo* Raddi × *S. melongena* L. crossings

If *S. gilo* Raddi is applied as mother plant and as pollinator the two varieties of *S. melongena* L. used by us, no hybrid seeds are obtained because the pollinated flowers of the plant get shed.

The hybrid seeds obtained in 1962 were sown in 1963, while those obtained in 1963 were sown in 1964. The characteristic numeric data of the hybrids are shown in Table 3. From the data of the Table it can be established that the productive capacity of hybrids depends on the crossing combinations. When

Table 3

*F*₁ generation of *Solanum melongena* L. × *Solanum gilo* Raddi hybrids

Crossings Years	S. m. (p) × S. g.		S. m. (w) × S. g.	
	1963	1964	1963	1964
Total number of plants	16	19	11	12
Plants producing fruit	14	7	1	1
Number of fruit on one plant (average)	13.00	8.14	1	5
Number of seeds in one fruit (average)	2.36	17.17	1	—

S. m. (p) = Common purple egg-plant

S. m. (w) = Common white egg-plant

S. g. = *Solanum gilo* Raddi

using the Common purple egg-plant as mother plant, the number of productive individuals, the number of fruit on one plant and the number of seeds in one fruit are considerably more than when the Common white egg-plant is used as mother-plant. The data of the Table show that the vital- and productive capacity of the hybrids depend definitively on which variety of the egg-plant is used as mother-plant.

2. The properties of *S. melongena* L. × *S. gilo* Raddi hybrids

In both breeding seasons the properties of the *F*₁ generation in the hybrids sown were registered. This was done partly in order to establish to which parent's properties the hybrids were most similar; secondly, to establish how the properties of the parents are getting inherited; thirdly, to determine in full knowledge of the above, whether they are really hybrids that have been brought about. Viz., an objection may quite reasonably arise that even in case of utmost care, the own pollen might get on the pistil and thus, what has actually happened cannot be considered inter-species crossing but self-pollination. Of course this objection cannot be accepted if in the *F*₁ generation there appear the properties of the pollinator plant.

The properties of development in the hybrids can be seen in Tables 4—7. In the Tables we find the three parents i.e. the Common purple egg-plant — S.m.(p) — the Common white egg-plant — S. m. (w) — and the *S. gilo* Raddi — S. G. —, as well as the hybrids in the case when as mother-plant the two varieties of *S. melongena* L. have been used while the pollinator plant was *S. gilo* Raddi.

The formations of shoot-system properties are shown in Table 4. As to height, there is no considerable difference between the parents and the hybrids, but considering width, the hybrids became much more spread than the parents. This was caused by the elongation of lateral shoots at the hybrids. Concerning

Table 4
Properties of the shoot-system

	Species, varieties and combinations				
	S. m. (p)	S. m. (w)	S. g.	S. m. (p) × S. g.	S. m. (w) × S. g.
The height of the shoot-system, cm ...	67.1	64.3	70.0	65.6	83.0
The width of the shoot-system, cm ...	40.0	45.5	70.5	160.7	172.1
The length of the longest lateral shoot, cm	52.9	56.8	97.5	134.1	128.3
The thickness of the shoot-system.....	thick	thick	loose	loose	loose
The colouring of the top of the shoot-system.....	purple	green	green	green	green
The colour of the bristles on the shoot-system.....	purple	green	none	none	none

S. m. (p) = Common purple egg-plant

S. m. (w) = Common white egg-plant

S. g. = *Solanum gilo* Raddi

Table 5
Properties of the foliage

Properties	Species, varieties, combinations				
	S. m. (p)	S. m. (w)	S. g.	S. m.(p) × S. g.	S. m. (w) × S. g.
Length of the leaf-blade, cm	28.2	20.6	12.0	11.1	10.3
Width of the leaf-blade, cm	19.4	15.0	7.8	7.2	7.0
Leaf-size index	1.45	1.37	1.54	1.54	1.47
Colour of the nervure on the leaf-blade	purple	green	green	purple	green
Colour of the bristles on the nervure .	purple	green	none	none	none

S. m. (p) = Common purple egg-plant

S. m. (w) = Common white egg-plant

S. g. = *Solanum gilo* Raddi

the thickness and colouring on the shoot-system as well as the colour of the bristles, the properties of *S. gilo* Raddi are dominating on the hybrid plants.

b) The formation of properties in the foliage is shown in Table 5. As to the length, breadth and the leaf size index, on the hybrids the properties of *S. gilo* Raddi were dominant. It is interesting to observe the heredity in colour of the nervure. When Common egg-plant with purple nervure, had been used

as mother plant, the nervure of the hybrids became also purple. The nervure of the Common white egg-plant agrees with that of *S. gilo* Raddi and thus, no difference could be made between hybrids and parents. As to the colour of the bristles, their existence or absence, the properties of *S. gilo* Raddi prevailed.

c) The formation of properties concerning inflorescence are shown in Table 6. As to the number of flowers found on one plant, values similar to those of *S. gilo* Raddi were obtained with, while in case of the Common white

Table 6
Properties of the flowers

	Species, varieties and combinations				
	S. m. (p)	S. m. (w)	S. g.	S. m. (p) × S. g.	S. m. (w) × S. g.
Number of flowers on one plant	14.1	32.5	11.5	10.7	62.0
Number of flowers in one inflorescence	2—3	3—4	3—6	4—7	5—8
The colour of the petals	purple	purple	white	purple	purple
The diameter of the flowers, cm	4.6	3.8	2.0	2.9	2.7

S. m. (p) = Common purple egg-plant

S. m. (w) = Common white egg-plant

S. g. = *Solanum gilo* Raddi

egg-plant values were even higher than those obtained with the mother-plant. The number of flowers on the hybrid plants was always higher than that of the parents. Concerning petals, it is always the colour of petals on the mother-plant that is dominating. The diameter of the flowers shows an average value of that of the parents.

d) Properties developing in the fructus are shown in Table 7. As to the fruit quantity — related to both parents, — lower values were obtained on the hybrids, though in hybrid fruit were also found seeds in some lower quantity. Concerning fruit colour, the properties of *S. gilo* Raddi were dominating in both types of hybrids.

The examination of the F_1 generation of the hybrids proves that inter-species hybrids between two varieties of *S. melongena* L. and *S. gilo* Raddi have been successfully produced with *S. melongena* used as mother plant. When applying as mother-plant *S. gilo* Raddi and as pollinator the two varieties used by us of *S. melongena* L., no hybrids could be produced.

The hybrids show certain properties of both parents as: those of the pollinator *S. gilo* Raddi and those of *S. melongena* L. being used as mother-plant which means that we have managed to produce inter-species hybrids between the two species.

Table 7
Properties of the fruit

Properties	Species, varieties and combinations				
	S. m. (p)	S. m. (w)	S. g.	S. m. (p) × S. g.	S. m. (w) × S. g.
The number of fruit on one plant	4.3	10.0	21.9	10.6	3.0
Total weight of the fruit on one plant	1.92	1.01	1.23	0.44	0.14
Total number of fruit in one inflorescence	1—2	1—3	1—5	1—2	1—3
The length of the fruit, cm	15.5	7.5	5.00	4.8	4.2
The width of the fruit, cm	9.1	5.7	5.6	3.6	3.1
Index of fruit-size	1.70	1.32	0.89	1.33	1.35
The colour of fruit being technically ripe	purple	white	red	red	red
The colour of fruit being biologically ripe	brown	yellow	red	red	red
Average number of seeds in one fruit	385.2	653.6	435.7	with green stripe 9.8	0.5

S. m. (p) = Common purple egg-plant

S. m. (w) = Common white egg-plant

S. g. = *Solanum gilo* Raddi

Conclusions

Inter-species hybrids have been produced between two varieties of *S. melongena* L.: the Common purple egg-plant and the Common white egg-plant and *S. gilo* Raddi. They can be produced only when *S. melongena* L. is used as mother-plant while *S. gilo* as pollinator. In the reversed case i.e., if *S. gilo* Raddi is used as mother plant and as pollinator *S. melongena* L., i.e. its two varieties, no inter-species hybrids can be obtained. When Common purple egg-plant was used as mother-plant, the number of plants bearing fruit, the fruit number on one plant and seed number in one fruit are considerably higher than in the case of the Common white egg-plant being used as mother-plant. The F_1 generation of the hybrids shows the properties of both parents: those of the pollinator *S. gilo* Raddi and of *S. melongena* L. used as mother-plant. That proves that between the two species it is possible to produce inter-species hybrids which inherit the properties in a mosaic-like way.

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PRELIMINARY REPORT ON THE TRANSLOCALIZATION OF THE NATURAL RADIOACTIVE ISOTOPE $^{40}_{19}\text{K}$ IN THE GERMINATING SEED OF *TRITICUM AESTIVUM* L.

By

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Localization and translocalization of the natural active isotope $^{40}_{19}\text{K}$ in the germinating seed of *Triticum aestivum* L. have been observed. As in available literature no work has dealt yet with this problem the issues obtained may contribute to a better understanding of metabolic changes in the germinating seeds.

Introduction

The natural radioactive isotope $^{40}_{19}\text{K}$ is localized in the non germinated seed. The translocalization of the isotope in the embryo and in the primary roots takes place during the process of germination. The isotope $^{40}_{19}\text{K}$ migrates from the primary roots to the centre where germination occurs. In the germinating seed, as a result of translocalizations, zones of different activity develop, as translocalization is directed specifically toward certain organs.

In several preceding studies I followed the topographic distribution of the natural radioactive isotopes $^{40}_{19}\text{K}$, $^{48}_{20}\text{Ca}$, $^{124}_{50}\text{Sn}$ in *Beta vulgaris* var. *saccharifera* (L.) Alefeld, $^{40}_{19}\text{K}$ in the fungi of the family *Polyporaceae* L. where I observed first of all the localization of the active isotopes referred to. In available literature no work has been found so far dealing with the translocalization and localization of the natural active substances in the germinating seed of *Triticum aestivum* L. as one of the components taking part in the series of physiological proceedings. The knowledge of translocalization of the natural isotope $^{40}_{19}\text{K}$ in the germinating seed may in the future contribute to another biological explication of the mechanism of metabolism in the germinating seeds.

Material and Method

The vegetable material, i.e. the seeds of *Triticum aestivum* L. was obtained from the culture UVURV in Prague—Ruzyne, at the harvest 1963. The negative radiograms were made according to the current method (MYSLIVEC 1958, Botanique d'agriculture 1962). As photographic material the photographic plates ISOPAN AGFA ISS 21° (din VEB Film Fabr. Kreis Bitterfeld DDR) were used, the period of exposition was 30×24 hours. Subsequently, the negative material was developed according to the current method. This proceeding was repeated 50 times.

The negative radiograms were evaluated from the point of view of isotope $^{40}_{19}\text{K}$ translocation. Qualitative chemical analysis to verify the presence of active elements was carried out analytically; for the control of chemical analysis dosimetric recording of the counter of

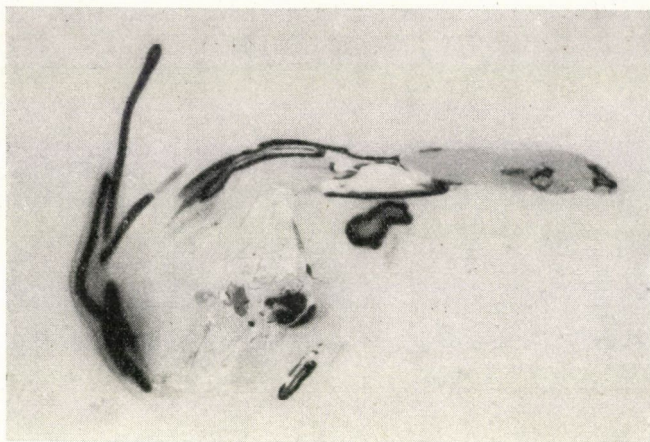


Fig. 1. Positive radiogram of the germinated seed of *Triticum aestivum* L., exposed for 30×24 hours, scale of enlargement $13 \times$

impulsions RA NZ Q 615 was used; this measurement took place at the Faculty of Natural Sciences of the Charles University, Department of Plant Physiology, in Prague.

Germination of seeds was conducted on filter paper at room temperature, with distilled water.

Results and Discussion

1. Localization of the natural radioactive isotope $^{40}_{19}\text{K}$ in the non-germinated seeds of *Triticum aestivum* L.

The natural radioactive isotope $^{40}_{19}\text{K}$ is localized in the whole seed in a homogeneous way, the relative activity has a value of the order of 10^{-11} curie.

The translocation of the active isotope is not evident.

The longitudinal section of the seed has proved the localization of the active isotope along the whole section, the exterior border being considerably lobate. The cross section of the seed has demonstrated the localization of the active isotope in the form of a star lobed at the six ends.

2. Localization of the natural radioactive isotope $^{40}_{19}\text{K}$ in the *Triticum aestivum* L. seeds after germination

Germination of the seed has produced a change in the topographical distribution of the natural radioactive isotope $^{40}_{19}\text{K}$.

Isotope translocalization took place resulting in the destruction of its localization and dislocalization of isotope and distribution of this isotope in the different phases of growth of the seed, due to the physiological variations in the seed.

a) Translocalization of the natural active isotope $^{40}_{19}\text{K}$ in the seed after germination: The process of germination took its course in two phases. The particular phases were specific for the translocalization of the active isotope $^{40}_{19}\text{K}$.

Phase I. — The germination of the primary roots has characterized the translocation of the active isotope to the primary roots and to the part closely attached. The relative activity of primary roots has represented $2,3 \cdot 10^{-11}$ curie.

The destruction zone of active isotope is about $1,2 \cdot 10^{-11}$ curie.

From the zone of destruction of active isotope the latter migrated through the primary roots in the filter paper which constituted the necessary humid medium for the germination.

Phase II. — The germination of the seed characterized by the translocalization of the active isotope of the non destroyed zone towards the embryo. At the embryo the active isotope is localized in the meristem.

Phase III. — The germinated seed with the primary roots and the developed embryo.

In the destruction zone of the active isotope of the first phase the active isotope $^{40}_{19}\text{K}$ was almost totally translocalized to the primary roots and migrated to the centre of germination. From zone non destroyed at the first phase the isotope has translocalized itself into the embryo where is localized in the meristem.

After the process of germination the localization of the active isotope $^{40}_{19}\text{K}$ has been verified in the following parts of the germinated seed:

1. in the primary roots; relative activity was $2,3 \cdot 10^{-11}$ curie
2. in the zone of destruction
3. in the superficial layers adjacent to the embryo
4. in the non-destroyed zone
5. in the embryo
6. in the meristem of the embryo; relative activity $2,3 \cdot 10^{-11}$ curie.

The migration I. E. the departure of the active isotope from the vegetable object took its course along the primary roots of the destruction in the centre.

Conclusions

Localization and translocalization of the natural active isotope $^{40}_{19}\text{K}$ in the germinating seed is a component of biochemical complexity of the metabolism in the germinating seed. Localization and translocalization of the isotope

supplies information on the movement of the quantities of the traces of natural radioactive substances in the germination process. In connection with biochemical research of the process of germination this method may have an importance in basic research work.

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CHANGES IN THE CELLS OF ROOT TIP DUE TO DEFICIENCY IN NUTRIENT

By

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The authors have examined the metabolic changes brought about by starvation in the root tip of maize and bean seedlings taken as a function of weight, dry material content, NA—P quantity and the formation of cell number. On ground of their experiments they have established that there appears, as a result of denutrition, very quick decrease both in weight and dry material, and cell divisions come to an end. The quantity of NA—P fractions also diminish, though to a considerably less extent than weight does. This latter phenomenon displays changes depending on plant species since in the case of maize both NA—P fractions have, as a result of starvation, decreased while with bean it has hardly changed as a response to 7-day denutrition.

Introduction

The regulation of metabolism is one of the most important aims at the cell physiology. The living plant cells often respond selectively to regulation influences. The character, physiological role and genetic stability of the compounds receiving the influences, have great share in this. Of the metabolism-modifying effects the most interesting ones are what might be permanent concomitant circumstances in the life of cell as e.g., force of gravity, degree of oxygen supply, starvation, water deficiency, high atmospheric pressure, etc. These effects call forth the "natural" reactions and metabolic change tendencies of the cell, and do characterize well the stability and importance of biologically active compounds (GARAY, 1964, STREET, 1963).

KONAREV (1953, 1954) thought to find out the effect of development-inhibiting starvation in the considerable decrease of mitoses and from this he concluded the diminishing of RNA (ribonucleic acid). Others, too, report on similar observations (MARÓTI, 1958) adding that, on the other hand, in the root-cells of bean the quantity of DNA—P (deoxyribonucleic acid phosphorus) does not change in the cell even after starvation. The same was experienced by KIMBALL and VOGT-KÖHNE (1961) in the case of *Paramecium* cells. Thus, the behaviour of the two fractions (RNA and DNA) of nucleic acid (NA) is not identically influenced by starvation.

The quantity of proteinaceous materials and especially of some amino acids get enhanced in the organ while that of others will decrease when influ-

enced by starvation (ROHRINGER, 1964). The material translocating effect evoked by starvation was also observed (FRIES, 1953).

It has seemed, therefore, desirable to control accurately, in the function of time, the effect of starvation causing metabolism, partly for the elucidation of contradictory data, partly for getting more proper knowledge on the changes brought about by starvation. This might promote a better comprehension of the development mechanism of plant cells since it would, by way of example, cast light also on the stability of DNA in the cell which is being considered constant from the view-point of heredity. In addition, from the change of the examined compounds we might conclude their biological importance, too.

Material and Method

The experiments were performed from September 1963 to December 1964. As material for the experiments a regional variety of bean being also used in common production (*Phaseolus vulgaris* L.) and a hybrid maize (*Zea mays* L. Mv₁, "Martonvásári hybrid") had been chosen. The selected seeds were swelled in the dark in Petri dishes on filter-paper wetted with distilled water, for 24 hours. Once the roots being as long as 5 mm. (1 day), they were cut and analysed. After this, the germinating seedlings were kept for another 7–9 days in dishes with distilled water and in total darkness so that the roots reached water through the holes of a perforated sheet. In the case of beans the seed coat was removed after 24 hours in order to diminish the danger of contamination. During the time of the experiments water was changed several times. Only beans and maizes with uninjured cotyledon or seed, were used. The cotyledons of bean and the seeds of maize became thoroughly etiolated; the former after 4–5 days, the latter in 5–6 days. We applied total darkness to prevent chlorophyll formation and photosynthesis. For analysis only a 5 mm. piece of the root tip taken from the taproot was used, having been cut daily at the same time with a special root-cutting implement (MARÓTI and SCHEURING, 1959).

As index of the changing metabolism the fresh and dry weight, the total phosphorus (P), ribonucleic acid phosphorus (RNA—P) and deoxyribonucleic phosphorus (DNA—P) content of the root tips were measured, and the cells of the root pieces counted. The aggregate sum of the two nucleic acid fractions added up to the total nucleic acid. For the extracting of the RNA—P and DNA—P we applied the method of OGUR and ROSEN (1950). The numerical evaluation was performed on the basis of phosphorus content, by the aid of a standard curve, with the Spectromom-360 photometer. The number of the cells has always been established by the same person with the aid of the Bürker-chamber, while the preparatory process performed on the basis of the BROWN and RICKLESS (1950) method. The numerical data are the mathematical mean values of 5 parallel experiments (HARTE, 1952).

Results

The absolute figures of experiments are shown in Tables 1, and 3. When reading them, we might establish that the change in metabolism indices as measured in the 5 mm. root tip of both experimental plants reflect starvation and the deficiency in nutriment, as well.

The root tip of maize had been analysed for 9 days. The first day showed continuous decrease in the fresh and dry weight. The material-content measured after the first day fell back, by the 9th day, to about its fifth (Table 1). Similar was the ratio in the decrease of the two nucleic acid fractions. RNA—P is by about 2–3 times more increased in the root than is DNA—P. This ratio

Table 1

Weight, NA-P content and cell number of the 5 mm. root tip,
in maize (*Zea mays* L. M_{v1}) after 1-9 day starvation

(\bar{x} = mathematical mean, s = scattering,
S. E. = standard error)

Time of experiment: days	Number of cells: 10 ³	Fresh weight	Dry weight	RNA-P	DNA-P	Dry weight in the % of fresh weight
		mg/organ		μg/organ		
1	\bar{x} 274	2.25	0.34	2.86	1.04	15
	s ± 1.12	±0.08	±0.04	±0.11	±0.08	
	S. E. ± 0.96	±0.04	±0.02	±0.06	±0.04	
2	\bar{x} 225	2.20	0.35	2.50	0.69	16
	s ± 1.11	±0.08	±0.02	±0.09	±0.10	
	S. E. ± 0.64	±0.04	±0.01	±0.05	±0.07	
3	\bar{x} 273	1.91	0.24	2.18	0.65	13
	s ± 0.95	±0.06	±0.04	±0.06	±0.09	
	S. E. ± 0.54	±0.03	±0.02	±0.03	±0.05	
4	\bar{x} 256	1.55	0.22	1.79	0.53	14
	s ± 0.94	±0.10	±0.03	±0.08	±0.06	
	S. E. ± 0.54	±0.05	±0.02	±0.04	±0.03	
5	\bar{x} 240	1.42	0.19	1.00	0.46	13
	s ± 0.71	±0.09	±0.02	±0.09	±0.08	
	S. E. ± 0.40	±0.05	±0.01	±0.05	±0.04	
6	\bar{x} 200	1.08	0.14	1.22	0.36	13
	s ± 0.80	±0.09	±0.03	±0.05	±0.06	
	S. E. ± 0.46	±0.05	±0.02	±0.03	±0.03	
7	\bar{x} 183	0.92	0.13	1.06	0.31	14
	s ± 0.59	±0.06	±0.02	±0.07	±0.07	
	S. E. ± 0.34	±0.03	±0.01	±0.04	±0.04	
8	\bar{x} 129	0.63	0.09	0.90	0.21	14
	s ± 0.63	±0.07	±0.03	±0.09	±0.08	
	S. E. ± 0.36	±0.04	±0.02	±0.05	±0.04	
9	\bar{x} 90	0.41	0.06	0.53	0.14	14
	s ± 0.94	±0.06	±0.03	±0.06	±0.06	
	S. E. ± 0.53	±0.03	±0.02	±0.03	±0.03	

Table 2

Percentual changes in metabolism indices and in those referring to the single cell, as measured in the 5 mm. root tip of maize, brought about by starvation

Time of experiment: days	Cell number %	Fresh wt %	Dry wt %	RNA-P %	DNA-P %	Fresh wt per cell	Dry wt per cell	RNA-P	DNA-P
						mg. 10^{-6}		μ g. 10^{-6}	
1	100	100	100	100	100	8,21 100%	1,24 100%	10,43 100%	3,79 100%
2	82	98	103	87	66	9.77	1.55	11.11	3.06
3	99	85	71	76	62	6.99	0.88	7.98	2.38
4	93	69	65	63	51	6.05	0.85	6.99	2.07
5	87	63	56	35	44	5.91	0.79	4.16	1.91
6	73	48	41	43	29	5.40	0.70	6.10	1.80
7	67	41	38	37	29	5.02	0.71	5.79	1.69
8	47	28	26	31	20	4.88	0.69	6.97	1.62
9	33	18	18	18	13	4.55 58%	0.66 53%	5.88 56%	1.55 41%

does not differ from that of normally developing roots. The number of cells examined daily, had also decreased considerably and on the 9th day we found but one third of the quantity of the previous day. From the obtained metabolism indices it can be concluded that during the period and under the conditions of the experiment the 5 mm. root tip of maize shows, day by day, a drop in weight, NA—P and cells. This decrease of material and cell is also displayed in the shape of root tip which gradually tapers off and becomes transparent. The dry material content expressed in fresh-weight per cent is, on the other hand, markedly high, being between 13—16%, and has shown no decrease in the function of the experimental time.

The conclusions that can be drawn from the absolute figures obtained in the analysis, are also supported by the converted values. We have thus expressed percentually and referring to one cell, respectively, the decrease in weight, NA—P and number of cells, appearing as a consequence of deficiency in nutrient.

The data of analysis made on the first day, were taken for 100%, and the results gained on the following days, were proportionated to that (Table 2). From the values referring to maize, it can be established that the examined materials disclose a decrease of the same sort due to the root being supplied

insufficiently with nutriments, —and they differ only in proportions. The most marked decrease has been experienced in DNA—P, having at the end of the experiment only 13 per cent of the original quantity. RNA—P has fallen back by 82 per cent. With weight data there is also a decrease of 82 per cent. The least it is with the cell number; related to the initial figure, 33 per cent have remained in the 5 mm. root tip. Thus, the percentual decrease referred to the organ, is also very considerable.

The change in weight and NA—P as referred to the cell points to a difference from what is calculated for the organ (Table 2). The rate of decrease is

Table 3

Weight, NA-P content and cell number of the 5 mm. root tip in bean (Phaseolus vulgaris L.) after 1–7 days of starvation

(\bar{x} = mathematical mean, s = scattering, S. E. = standard error)

Time of experiment: days	Number of cells 10 ³	Fresh weight	Dry weight	RNA-P	DNA-P	Dry weight in the % of fresh weight
		mg/organ		μg/organ		
1	\bar{x} 620	7.75	0.91	1.68	1.30	12
	s ± 24	±0.62	±0.11	±0.22	±0.12	
	S. E. ± 12	±0.35	±0.07	±0.12	±0.07	
2	\bar{x} 588	6.13	0.70	1.50	1.30	11
	s ± 32	±0.32	±0.11	±0.19	±0.11	
	S. E. ± 16	±0.07	±0.06	±0.10	±0.06	
3	\bar{x} 560	4.78	0.44	1.28	0.94	9
	s ± 20	±0.97	±0.13	±0.18	±0.02	
	S. E. ± 8	±0.11	±0.07	±0.09	±0.01	
4	\bar{x} 424	4.18	0.38	1.16	0.78	9
	s ± 40	±1.20	±0.05	±0.02	±0.11	
	S. E. ± 16	±0.48	±0.02	±0.01	±0.06	
5	\bar{x} 424	3.44	0.31	1.12	0.75	9
	s ± 12	±0.16	±0.09	±0.03	±0.07	
	S. E. ± 4	±0.09	±0.04	±0.01	±0.03	
6	\bar{x} 344	2.43	0.20	1.02	0.66	8
	s ± 32	±0.12	±0.06	±0.06	±0.06	
	S. E. ± 16	±0.07	±0.03	±0.03	±0.03	
7	\bar{x} 336	2.37	0.19	0.98	0.60	8
	s ± 16	±0.11	±0.06	±0.02	±0.12	
	S. E. ± 8	±0.06	±0.02	±0.01	±0.06	

Table 4

Percentual changes in metabolism indices and changes referring to the single cell, as measured in the 5 mm. root tip of bean, and brought about by starvation

Time of experiment: day	Cell number %	Fresh wt %	Dry wt %	RNA-P %	DNA-P %	Fresh wt per cell	Dry wt per cell	RNA-P per cell	DNA-P per cell
						mg. 10^{-6}		μ g. 10^{-6}	
1	100	100	100	100	100	12.50 100%	1.47 100%	2.71 100%	2.09 100%
2	95	80	77	89	100	10.42	1.19	2.55	2.21
3	90	62	48	76	72	8.53	0.78	2.28	1.66
4	68	54	42	69	60	9.86	0.89	2.73	1.84
5	68	44	34	67	58	8.11	0.73	2.64	1.77
6	55	31	22	61	51	7.06	0.58	2.96	1.91
7	54	30	20	57	46	7.05 56%	0.56 38%	2.91 107%	1.78 86%

much less. On the 9th day there can be found in the cells 58 per cent of the fresh weight, 53 per cent of the dry weight, 56 per cent of RNA—P and 41 per cent of DNA—P of what was measured on the first day. The percentual difference as calculated for the organ and cell, is caused by the fact that the decrease in cell number was considerably less than that in weight and NA—P. However, from both the absolute and the calculated values it becomes evident that under the effect of starvation the development of the root does stop, the number of cells per pieces of the same length becomes less, weight and NA—P content diminish. The effect of starvation can also be followed within the individual cell though it is not so conspicuous.

With the other experimental plant, bean, we had made analyses for 7 days, and the data have been summarized in Table 3. The metabolism of bean differs from that of maize in many respects. Thus, in root pieces of the same length, the number of cells is the double of that of maize both at the beginning and the end of the experiment. On the other hand, the weight of the root pieces is considerably greater. Accordingly, the weight of the individual cells is also more than in the root of maize, whereas the percentual dry matter content of bean root is considerably less than that of maize; the difference is about between 12 and 8 per cent (on the 7th day), and from the first day on, it continuously decreases.

Out of the NA-s, there is more RNA in maize, while in bean DNA is prevailing per root piece. Their percentual decrease is greater in the maize.

However, the results obtained on the bean root also show that the lack of nutriment causes inhibition both in growth and development (Table 4). The values of NA—P calculated for the cell equally show that their quantity did not decrease considerably on the 7th day either (DNA—P 86 per cent), or perhaps, it even increased (RNA—P 107 per cent) compared to the quantity gained on the first day. Thus, the indices in the bean root, too, diminish under the influence of starvation except the fractions of NA—P. Accordingly, these materials prove to be more stable constituents in bean than in maize root.

Discussion

The mechanism of cell, and especially some catabolic phenomena might be traced by the withdrawal of nutritive materials as well (KIMBALL and VOGHT-KÖHNE, 1961, ROHRINGER, 1964). In our experiments we have brought about the withdrawal of nutriment and caused starvation by preventing the supply of substances used up for natural development and growth. The circumstances of the experiment entirely excluded the uptake of nutriment by the seedlings from their environment since distilled water did not contain suitable ions, while the dark experimental surroundings prevented photosynthesis by inhibiting the formation of green pigments. The nutritive materials of the seed and cotyledon, respectively, got entirely exhausted after some (5—6) days (MARÓTI, 1958), proving that the conditions of starvation had been given. In our experiments we expected to receive an answer to the problem whether both NA components decreased at the same rate, and the change of these was proportionate to the change in cell weight and dry material. On the other hand, we wanted to find out a difference or an agreement in the response of certain plant species to starvation. The data of analysis made on the first day, showed the normal weight, nucleic acid phosphorus and cytological relations. Data of similar order were published by WOODSTOCK and SKOOG (1962) referring to maize, and by MARÓTI (1958) concerning bean, thus the initial (first day) data might be considered acceptable. As the time of the experiment went by, the weight of the root piece examined as well as its NA—P content diminished considerably. This can be attributed not only to the loss in water and dry material content, the number of cells has also become less in the 5 mm. piece. Concluding from the percentual change of root weight and cell number, their size has presumably grown less, too, and this has been as well, manifested itself in the tapering of the roots. Such a root tip grows transparent and light yellow. Similar morphologic changes were experienced by FRENÝÓ (1957) with starving onion roots. From the decrease of weight and cell number it can further be concluded that cell division has almost entirely ceased, a fact that also means the "ageing" of the cells. Similar slowing down in cell division was experienced by KONAREV (1953, 1954) when having kept isolated roots in distilled water.

It is interesting to note that as early as the 3rd day of the experiment there was a decrease in the weight, NA—P content and cell number of the root tip, though one might suppose that at this time sufficient nutritive material was still available in the seed and cotyledon, as had been proved by MARTOS (1956). This early "starvation" can be interpreted but one way: the reserves of the seed go for the most part into the shoot, and once the seed is exhausted, even the materials that have already got into the root, become translocated and reutilized in the lateral roots and the shoot. This eventuality was observed by FRIES, too (1953). On breeding pea seedlings that had been stripped of their cotyledons, he experienced that root development lagged behind the development of isolated roots as, in the former case, certain materials had migrated into the shoot. When, on the contrary, the cotyledon was left on the seedling, the development of root was quite as well intensive, because the root had not been deprived of its nutritive materials by the shoot. Such migration of materials as a result of starvation, was also described by KONAREV (1953, 1954), who made his statement referring to RNA—P.

As to answer the questions constituting the direct aim to these experiments, on the basis of results gained in the analyses we might give the following answer: The root tip of both experimental objects has day by day contained less cells, their water content (fresh weight), dry material and NA—P content have gradually decreased. This is evident due to increasing starvation. However, the divergence in the percentual trends of the dry material in the two plant species is rather interesting. While with maize it did not change essentially during the 9 days, in the case of bean the dry material was considerably less on the 7th day than it was on the first one. This shows the ratio of water content and dry material to have become unbalanced, and points to the great vacuolization of the cells, a phenomenon that can also be considered as the ageing of tissues (BROWN et al. 1952). Examining the decrease of the two NA—P fractions observed in the root tip, it can be established that their change ratio is, within the species, less divergent. However, the two species shows an outstanding difference in the decrease (57 and 46 per cent and 18 and 13 per cent, respectively). If the ratios of quantities referring to the cell are compared, we obtain similar results (107 and 86 per cent and 46 and 41 per cent, respectively). These ratios show that the change of metabolism influenced by starvation, is not the same with the two plant species. From the above values one can also conclude that while with maize the catabolic reactions brought about by starvation are essentially parallel both with the whole piece of root and the individual cells and thus weight decreases are proportionate to the lessening of NA—P fractions; with the bean this is not the case. With the latter the general material content shows twice as much decrease as that of the NA—P fractions. This phenomenon is especially conspicuous in the case of RNA—P and DNA—P referred to the cell, where the initial (first day) quan-

tity and that established at the end of the experiment (7th day) are almost the same. Accordingly, with bean the NA — P fractions seem to be stable compounds, while with maize they are not.

Our experimental results are also supported by the observations of KONAREV (1953, 1954) who had noticed the decrease of RNA content in the root and the stopping of cell division caused by starvation. Similar decrease in the material is described by ROHRINGER (1964) who observed, as a result of starvation, the increase of amino acids connected with respiration and the decrease of other important amino acids. KIMBALL and VOGHT-KÖHNE (1961) found on *Paramecium aurelia* the decrease of RNA and protein only as a result of starvation or limited nutriment, the quantity of which increased again if normal nutrition was rendered possible. A close parallel was also found between the proportion of decrease of the two compounds. On the other hand, diminishing of DNA was not experienced even after starvation. We, too, came to the same conclusion (MARÓTI, 1958) in the course of our previous experiments. On the basis of our experimental data and those available in literature, it can be established that starvation brought artificially starts very soon the catabolic trend of metabolic processes. This promotes also the eventual migration of material from the root. In addition to the weight decrease of the root, inhibition in cell division and percentual decrease of the dry material will also occur. The change in NA—P fractions produced by starvation depends on plant species, a more extensive and satisfactory explanation of which is not yet known.

Conclusions

On the basis of our experimental results we have established that for the intensive development of the seedling, the nutritive material stored in the seed will do for very short time only. Under the circumstances of starvation first the growth and development of the tap-root gets stopped, the main cause of it being partly the fact that in such a case the nutritive materials in store will rather migrate into the shoot, and partly because the shoot deprived even the root of the necessary metabolites. One could also establish that in the root cells there is an immediate response to deficient nutrition, this being manifested by their changed metabolism. This reaction shows the same (decreasing) tendency in respect of the examined indices, however, its intensity is varying in accordance with plant species. In connection with NA decrease brought about by starvation, the idea may occur that out of the nucleic acid supply of cells only the "essential" "fractions" survive; what are absolutely necessary for the vital processes. On the other hand, the quantity of the fractions is determined by the difference in species, and thus the difference appearing between the two species, is understandable. From the decrease

of NA as referred to the organ and even more to the cell, it can be concluded that this may be in connection with the genetic stability of the plant.

In connection with the decrease of DNA—P in the root cells of maize, the question arises, whether we have to reckon with the lessening of the seed material i.e. the change of stability of DNA in the cell or with the change of the higher polyploid grade of cells. In lack of direct experiments the problem cannot be solved definitely, however, on the basis of theoretical considerations, each of these reasons or both together, might cause the experienced decrease.

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PREVENTION OF AMMONIA TOXICOSIS WHEN FEEDING UREA

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In order to prevent ammonia toxicosis occurring when feeding urea, and for the sake of making better use of it by the developing ammonia bacteria, I have produced urea preparations of retarding effect, called P_{16} and P_{22} .

According to the results of the experiments, the dose of the urea preparation P_{22} containing 10 g of urea, has but slight influence on the ammonia concentration of rumen liquid. The urea and ammonia concentration in the blood of *v. jugularis* develops accordingly.

The doses of P_{16} and P_{22} urea products containing 10 g urea each, cause significantly less ammonia concentration in the rumen liquid than crystalline urea of the same amount.

The mixture of the two kinds of urea products — with active agent ratio 1 : 1 —, containing 20 g urea, was well tolerated by the ruminants being fed in one dosis.

Introduction

In the practical foraging of cattle and especially of sheep, the problem of feeding urea in order to eliminate or reduce the frequent occurrence of ammonia toxicosis, — is not yet solved entirely.

When feeding fodder rations enriched with urea, and prepared on the spot, the frequent ammonia toxicoses mostly occur due to the lack of proper accuracy and caution. The problem is rendered more serious by the fact that between the urea doses tolerated by certain ruminants and those already producing ammonia toxicosis, — the difference is insignificant.

According to LEBARS—SIMONNET (1959), ANNICOLAS, and co-workers (1956) 0.5 g/wt.kg of fodder fed to sheep may cause death. HORNOIU (1959) on the other hand, points to the fact that urea fed in solved state, might be poisonous already in the amount of 0.25 g/wt.kg of fodder. According to the experiences of TANGL—KURELEC—DÖRNER (1955), for the developed (50 kg) combing merino sheep the advised dosis of urea is 7.5 g, — for feeding twice a day, this being 15 g.

Besides higher urea-uptake than the required, ammonia toxicosis is evoked by the extremely quick dissolving capacity and the hydrolysis of urea. From the urea getting in the rumen of ruminants, there develops suddenly a large quantity of ammonia. According to JUHÁSZ (1962), of the ammonia developed only about one fifth is taken up primarily by the microorganisms of

the rumen. The larger share of the ammonia being absorbed through the rumen wall, gets into the blood of the *v. portae* and then into the liver. Should the quantity of absorbed ammonia surpass the capacity of liver and that of other detoxicating systems of the organism, the ammonia concentration will suddenly increase.

According to the results obtained, among others, by HOLZSCHUH—WETTERAU (1962), and then by JUHÁSZ (1962), with 500—1400 $\mu\text{g}/100$ ml ammonia concentration developing in the blood of *v. jugularis*, there appear symptoms of ammonia toxicosis, and in serious cases the ruminants will die. The physiological symptoms of toxicosis were described by COOMBE—TRIBE (1958). Urea is a qualitatively suitable nitrogen source as proved by the experiments of BATES—JACOBSON (1961), however, the large amount of ammonia developing in consequence of quick dissolving and hydrolysis might be poisonous and not even the bacteria can make use of it economically for protein synthesis. This is proved by the experimental results of AGRAWALA—DUNCAN—HUFFMANN (1957), too.

Nowadays, however, beyond fighting back ammonia toxicosis, the main requirement appears to be, under given circumstances, the promotion of the best possible utilizing of urea fed to animals. It seems that such a kind of synthetic nitrogen source would be needed with which the formation of ammonia is a slow process. This might guarantee that longer time would be available for the uptake and incorporation of ammonia developing from urea. Thus, simultaneously with the elimination of the danger of ammonia toxicosis, there might be possibilities for enhanced protein synthesis of the microorganisms of the rumen.

For checking the hydrolysis of urea, i.e. the formation of suddenly developing and in most cases high ammonia concentration, there are two possibilities available for the time being. KOBASHI—HASE—UEHARA (1962), while examining the inhibitors of urease enzyme, established that urease enzyme of vegetable origin, was efficiently and selectively inhibited by acetohydroxamic acid. According to the investigations of BAINTRNER Jr. (1964), with acetohydroxamic acid the activity of urease produced by the rumen bacteria can also be inhibited *in vivo*.

Another possibility is to prolong the dissolving of urea, i.e. to achieve that the urea getting into the rumen should become dissolved and hydrolysed more slowly — without the inhibition of enzyme activity. In my hypothesis, while dissolving, urea meets gradually with the hydrolysing enzyme active rumen liquid.

In the course of preliminary experiments I produced various urea preparations of retarding effect (SZABÓ, 1963). Lozenges and granulates had been coated with an alcoholic solution of shellac. Later (SZABÓ, 1964) I developed the protective layer inhibiting dissolution by way of pearling technique on the

surface of ballshaped urea granules with 0.5—2 mm diameters. On the surface of the granule products I have developed the protective layer in such a manner that one unit of the urea product P_{16} gets dissolved and hydrolysed in the rumen of the sheep in 2 hours, while similar quantity of P_{22} product in four hours. These investigations indicate that certain urea products, as against crystalline urea, dissolve in a prolonged way.

Materials and Method

I have looked for a reply to the problem that what an effect is produced by 10 g of crystal urea and the equivalent amount of the urea products with slower dissolving rate, as well as 20 g of a mixture of the two products in the ratio 1 : 1 regarding active agent.

For the experiment 3 Hungarian combing merino sheep (being on an average of 50 kg) with rumen fistula, have been used. With the sheep 5 experiments were performed in series, marked I, II, III, IV and V. Between each experiment 8—8 days of pause was kept, and I have always come back to feeding fodder without any supplement.

Experiments

- I. Fodder ration without supplement (control).
- II. Fodder ration + 10 g of crystalline urea.
- III. Fodder ration + P_{16} urea product corresponding to 10 g of crystalline urea.
- IV. Fodder ration + P_{22} urea product corresponding to 10 g of crystalline urea.
- V. Fodder ration + the mixture of P_{16} and P_{22} urea products in the ratio 1 : 1 regarding active agent, corresponding to 10 g of crystal urea ("big ration").

Table 1

Composition of fodder rations relatively rich in raw fiber, — grams

Name of fodder	ration						N	Starch	Starch value	
Barley	30	27.28	2.22	2.44	1.97	1.20	0.47	15.53	22.22	22.66
Extr. sunflower	30	27.79	9.86	10.30	9.59	5.02	1.87	—	15.38	16.06
Maize	250	227.25	16.75	17.72	16.25	3.47	3.40	156.70	212.40	213.77
Meadow hay	300	277.44	12.93	14.01	10.74	84.18	4.39	—	91.20	94.29
Straw	400	373.56	5.68	4.80	2.48	114.60	3.04	—	85.48	87.68
Total:	1010	933.32	47.44	49.27	41.03	238.47	13.17	172.23	426.69	434.46
									S. r.:	S. r.:
									1:10.1	1:8.38

Test samples were taken every second day. The samples of rumen liquid were obtained through the rumen fistula, while the blood samples were gained every day alternately from the right — and left side *v. jugularis*. Sampling intervals were established so that test material was taken 1 hour before each feeding and then 1, 3, 5, 7, 9 hours after the ingestion of fodder and the proper amount of urea ration.

Sheep were given fodder rations twice a day, at 6 and 16 o'clock, while urea doses together, once a day at 7 o'clock.

I have determined the ammonia concentration of rumen liquid by the method of SZEGE-DI-JUHÁSZ (1956-57), the ammonia content of blood by that of JUHÁSZ-SZEGEDI (1958), and the urea concentration of blood with the aid of the method of KITAMURA-UCHI (1959), parallelly.

Results and Discussion

When evaluating statistically the data, the max. concentrations obtained during the experiments were processed. This arrangement seems to be effective because from utility point of view of urea products, the important thing is to know how much the ammonia concentration of the rumen liquid and of the blood of the *v. jugularis* as well as the urea concentration of the latter will be.

Table 2
Changes of ammonia concentration in the rumen liquid
mg % (\bar{x})

Hours of sampling	1 (6)	1 (8)	3 (10)	5 (12)	7 (14)	9 (16)
I.	32.04	30.50	31.33	33.41	25.91	22.62
II.	43.04	90.37	78.58	56.25	46.87	41.95
III.	40.83	64.54	71.37	50.79	40.75	35.75
IV.	34.54	39.08	38.75	45.04	36.08	31.95
V.	55.20	79.75	102.00	95.91	84.08	80.29

Changes of blood-urea-concentration mg % (\bar{x})

Experiments	I.	24.66	26.41	27.60	26.93	25.77	26.08
	II.	29.22	35.52	45.47	51.85	48.31	47.22
	III.	30.00	34.47	41.48	46.29	43.81	41.48
	IV.	28.87	33.00	35.89	40.35	40.43	39.70
	V.	28.00	33.08	41.56	51.00	56.25	59.64

Changes of blood-ammonia-concentration μ g % (\bar{x})

I.	110.83	111.66	111.26	117.50	110.83	113.75
II.	152.08	392.08	241.66	134.16	117.50	125.83
III.	123.95	203.75	317.50	206.66	164.58	155.80
IV.	136.66	156.25	148.33	149.58	124.16	124.58
V.	111.25	219.58	490.00	473.75	334.58	197.50

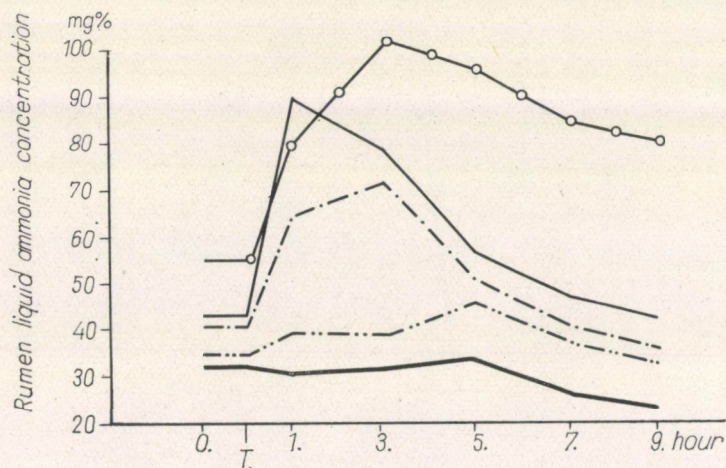


Fig. 1. Changes in the ammonia concentration of rumen liquid of the sheep

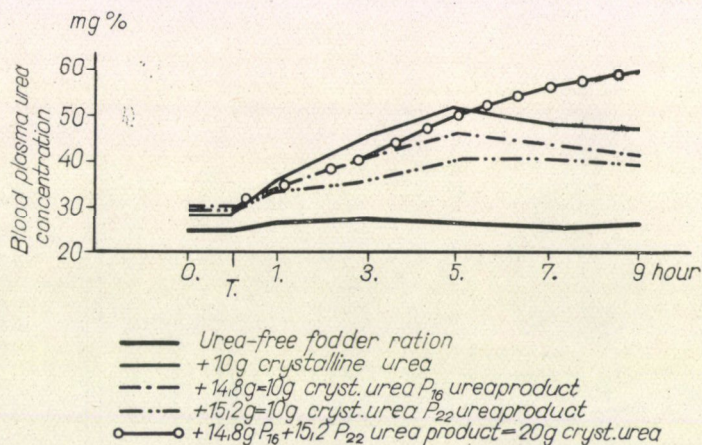


Fig. 2. Changes in the urea concentration of blood plasma of the v. jugularis in sheep

The mean values of ammonia concentration changes in the rumen liquid and in blood as well as the mean values of urea concentrations in blood are shown in Table 2 and Fig. 1, 2, 3.

To start with, it had been investigated how much the value of the max. concentrations obtained on that day, was as compared to the concentrations occurring before feeding. Here fodder test was calculated because we had to establish whether the max. value was greater and if so, how much greater it was than the initial value.

Depending on whether the sheep had been fed, in the individual experiments, with the fodder rations not being supplemented, or with rations supplemented with 10 g of crystalline urea and finally, with the corresponding quan-

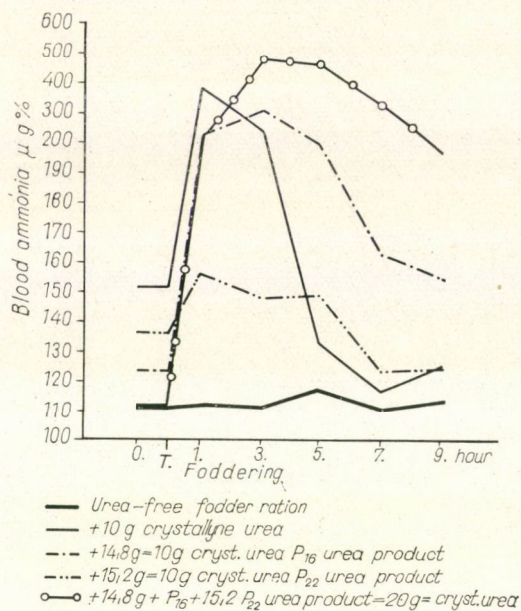


Fig. 3. Changes in ammonia concentration of the v. jugularis in sheep

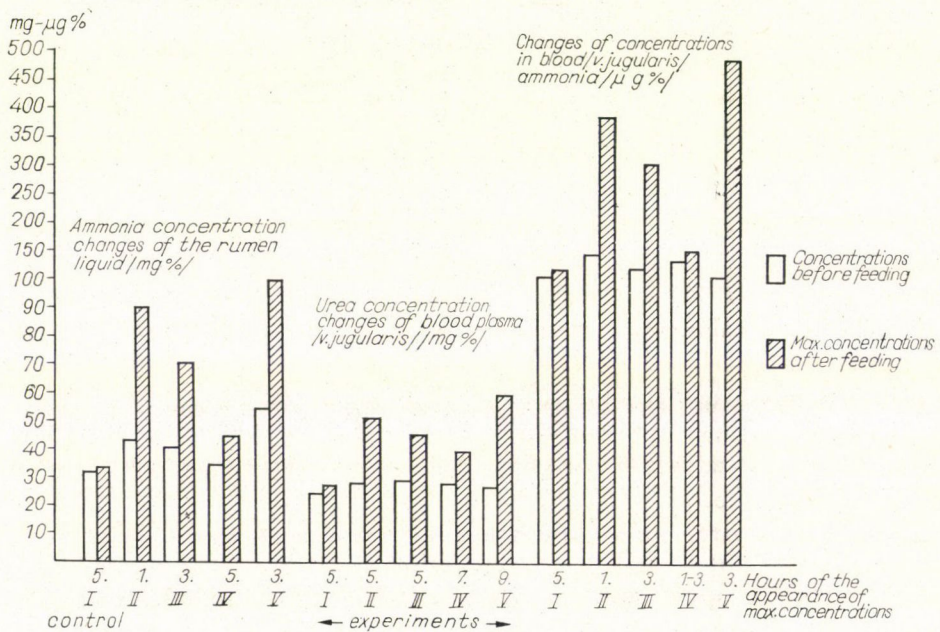


Fig. 4. Comparative representation of the max. concentrations of ammonia, blood plasma, urea in the rumen liquid, and the ammonia in blood (v. jug.) before and after feeding

Table 3
Mean values of the maxima

Experiments	Rumen liquid ammonia mg %	Blood urea mg %	Blood ammonia μ g %
I.	39.08	28.25	119.17
II.	97.17	53.15	387.92
III.	73.12	48.79	317.50
IV.	50.42	42.23	190.00
V.	109.17	60.90	520.83

Table 4
Study of the differences in the maxima obtained during the daily examinations (6–16^h) and the values gained before feeding
(Mean values, scatterings, and P % values)

Experiments	Ammonia level of the rumen liquid mg %			Blood-urea level mg %			Blood-ammonia level μ g %		
	\bar{x}	s	P %	\bar{x}	s	P %	\bar{x}	s	P %
I.	7.54	3.41	≤ 0.1	3.58	1.82	≤ 0.1	8.33	3.58	≤ 0.1
II.	55.00	18.26	≤ 0.1	23.91	5.80	≤ 0.1	236.66	115.29	≤ 0.1
III.	32.29	17.26	≤ 0.1	18.72	6.28	< 1	193.75	110.06	≤ 0.1
IV.	15.71	12.41	< 0.1	13.31	3.34	≤ 0.1	59.92	34.47	≤ 0.1
V.	53.96	16.85	≤ 0.1	32.89	6.05	≤ 0.1	409.58	83.54	≤ 0.1

tity of P₁₆, P₂₂ and the “big ration” of urea product respectively, the max. concentration was reached at different dates. The shifting of time as experienced in the course of experiments, is demonstrated in Fig. 4.

The results show that the daily max. concentrations are everywhere significantly higher than the initial concentrations. As a result of the fodder ration consumed (Experiment I), the ammonia concentration of the rumen liquid, and the urea and ammonia concentration of blood increase without supplementing any urea. It can be established that this increase surpasses the spontaneous fluctuation (scattering). The mean value of the maxima is shown in Table 3. When examining the ammonia concentration of the rumen liquid, it was found that the average of differences is the lowest in the control (I.) experiment, and in succession there follow the experiments with P₂₂ (IV.), P₁₆ (III.), the crystalline urea (II.), and the “big ration” (V.). The results are shown in Table 4.

When examining the maxima of urea and ammonia concentrations in blood taken from the *v. jugularis*, the same sequence might be established. With these calculations, variance analyses with several respects have been elaborated. Results are illustrated in Table 5.

Table 5
Results of fodder test calculated on the basis of variance analysis
(Difference in mean values and P % value)

Experiments	Rumen liquid ammonia mg %		Blood-urea mg %		Blood-ammonia μg %	
	diff	P %	diff	P %	diff	P %
I—II.	—58.09	≤0.1	—24.90	≤0.1	—268.75	≤0.1
I—III.	—34.04	≤0.1	—20.54	≤0.1	—198.33	≤0.1
I—IV.	—11.34	>5	—13.98	≤0.1	—70.83	>5
I—V.	—70.09	0.1	—32.65	≤0.1	—401.66	≤0.1
II—III.	24.05	≤0.1	4.32	>5	70.42	>5
II—IV.	46.75	≤0.1	10.92	<0.1	197.92	<0.1
II—V.	—12.00	>5	—7.75	<0.1	—132.91	<0.1
III—IV.	22.70	<0.1	6.56	<0.1	127.50	<0.1
III—V.	—36.05	<0.1	—12.11	<1	—203.33	≤0.1
IV—V.	—58.75	≤0.1	—18.67	<0.1	—330.83	≤0.1

Summarizing the results of calculations, it becomes evident that when examining the ammonia concentration of rumen liquid, and the urea and ammonia concentrations of blood, the urea product P_{22} —though being significantly higher than the value of the control experiment (I.), — gives the least max. concentrations as compared to crystalline urea and the P_{16} as well as the “big ration” urea products. This is surpassed by the product P_{16} , however, it ensures significantly less ammonia concentrations than similar quantities of crystalline urea. Thus the urea product PO_{16} containing 10 g urea, and even more the product P_{22} , are advantageous for sheep bringing about — under given foddering circumstances, — an increase of ammonia concentration being insignificant from the view-point of toxicity. It is worth mentioning that regarding the ammonia concentration of blood (data not published yet), I have obtained more advantageous values after feeding rations being poorer in raw fiber.

Conclusions

From the proteins of the components of the fodder ration that contains 13 g nitrogen, being of "fiber rich" character and without supplemented, ammonia will develop slowly. Max. ammonia concentration could be observed only in the 5th hour after ingestion of fodder. Besides the composition of rations being fed in the experiments, 10 g of crystalline urea has produced equally significant increase in the rumen of the sheep as compared to the ammonia concentration of the rumen liquid before feeding. This conclusion refers also to the P_{16} urea product with the comment, however, that after its uptake the mean values of ammonia concentrations in the rumen liquid are lower than those obtained for equal amounts of crystalline urea. The active agent of the urea product P_{22} gets dissolved slowly. Consequently, only slight increase of concentration can be observed as compared to the max. ammonia concentration obtained in rumen liquid after feeding urea-free rations. Since the urea and ammonia concentrations of blood are dependent on the ammonia concentration of the rumen liquid, the values of them were forming similarly in the experiments.

It can be supposed that the ammonia developing slowly from the urea products, might be better utilized by the microorganisms of the rumen for protein synthesis than those developing suddenly from crystalline urea.

In my opinion, through the slower dissolving of urea, the rate of ammonia-development and the rate of its utilization from the rumen might be brought into approximately proper equilibrium.

Under given feeding conditions, a mixture of urea products being mixed in suitable ratio, might ensure that sheep endure, without toxicosis, more urea than the ratio of 7.5 g considered best so far. According to the experiments, we might also reckon with a more favourable utilization of urea-nitrogen.

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THE DIFFERENTIATION, MICROSCOPIC AND SUBMICROSCOPIC STRUCTURE OF GIANT CELL WALL IN THE PERICARP OF CAPSICUM ANNUUM L.

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Authors have examined the wall of the giant cells in the pericarp of *Capsicum annuum* L. with phase contrast- and polarizing microscope. They have established that the refracture of these cell walls is negative, thus the microfibril orientation is generally transversal. They have also recognized and described the fact that the structure of the giant cells, — considering mainly its being foveolated, — is different on the various sides of the cell depending on which tissue and celltype, respectively, it is in contact with. In accordance with the types of the neighbouring cells, four different regions of the giant cell could be established from the point of view of structure.

Introduction

Several, morphologically and physiologically different types of the parenchyma tissues develop in the different parts of the vegetative and reproductive organs of the plants. In this connection the parenchyma cells might get differentiated in several ways concerning the shape and size, cell content and, last but not least, the microscopic and sub-microscopic structure of the cell wall (CZAJA 1958). Microscopically, the latter manifests itself best in the development of the thickenings of the cell walls, while in sub-microscopic order of magnitude in the orientation of microfibrils.

It has been established especially by polarizing microscope investigations carried out with *Avena coleoptyl*, that in the wall of isodiametric parenchyma cells the microfibrils generally settle in disorder (optically isotropic), however, in the wall of the elongated parenchyma cells there might occur approximately transversal fibrillar state (optically positive), and in certain cases definite spiral orientation was noticed (PRESTON, 1938). According to the observations of WUHRMANN—MEYER (1939) and FREY—WYSSLING (1942), the initial transversal fibrillar state passes over to the axial fibrillar state in the course of the longitudinal growth of the cell. WARDROP—CRONSHAW (1958) have described explicit crossed microfibril orientation in the parenchyma cell walls of *Avena coleoptyl*, — otherwise a property of prosenchymatic cells only.

According to electron microscope studies, the formation of the foveolae is a result of special arrangement occurring here and there in the microfibril tissue, (MÜHLETHALER 1950; FREY—WYSSLING—STECHER 1951; SCOTT—

HAMNER—BAKER—BOWLER 1956; FREY—WYSSLING 1959; ROELOFSEN 1959) being the most frequent and conspicuous signs of the differentiation in the cell wall on parenchyma cells. The size and distribution of the foveolae are rather uniform in the wall of the cell-types.

Some more complicated cases of such cell wall differentiations can be expected in case of parenchyma cells of special situation and formation especially with what are in contact with the cells of other kinds of tissues. From this point of view it seemed promising to examine the extremely big, so-called giant cells in the pericarp of *Capsicum annuum* L. — Each of these giant cells is — in its different sides, — in contact with other, altogether four, cell types. The more intensive study of the giant cells has been justified also by the circumstance that the structure of the pericarp of *Capsicum annuum* L. was described in details (AUGUSTIN 1907; MOELLER—GRIEBEL 1928; GASNER 1931; MODOR 1946; MÁNDY 1955; KONECSNI 1957), however, the structure of wall at the giant cells has not been studied closely so far. It is to be mentioned that the detailed anatomical examinations were mainly carried out for practical purposes and aimed at establishing and developing the possibility of the microscopic quality-control of red pepper being used as spice.

Material and Methods

For our investigations the developed fruit of *Capsicum annuum* L. var. *abbreviatum* was used. For informative observations young, not fully developed fruit were also gathered. The pericarp was cut into pieces of 2×2 cm, then put into triaethanolamin and kept for 1—2 hours at 80°C temperature in order to make the tissues pulpy and to have the cell-content removed. The pieces of pericarp thus treated were washed with water, and then the giant cells isolated under binocular preparing microscope. The prepared giant cells were cut up in the length with a pair of fine scissors and the cell wall was spread. The cell walls thus obtained were covered in water or watered glycerine and examined in phase contrast microscope as well as in polarizing microscope (between crossed nicols). The character of the double refraction was established by inserting first-rate red sheet. For performing the polarizing microscope examination, part of the preparations was stained with a 1% watery solution of Congo red. In certain cases the cell wall was divided into layers and these were examined separately.

Results and Discussion

The giant cells are elongated in the longitudinal direction of the fruit, their length being 2—3 mm, and their width 0.6—0.8 mm. After the isolation of the cells it can be well observed in the stereomicroscope that on their two ends they become gradually narrower and barrel-shaped (Fig. 10). From the works of authors already mentioned who have been engaged in the anatomy of the pericarp, it is well-known that the giant cells are located under the surface of the inner side of the pericarp. Their relationship with the adjoining tissues can be easily recognized on the cross-section of the pericarp (Fig. 1). Each giant cell is in contact with the inner epidermis of the pericarp on its side facing the hollow of the fruit. Further on, in our paper this region of the giant

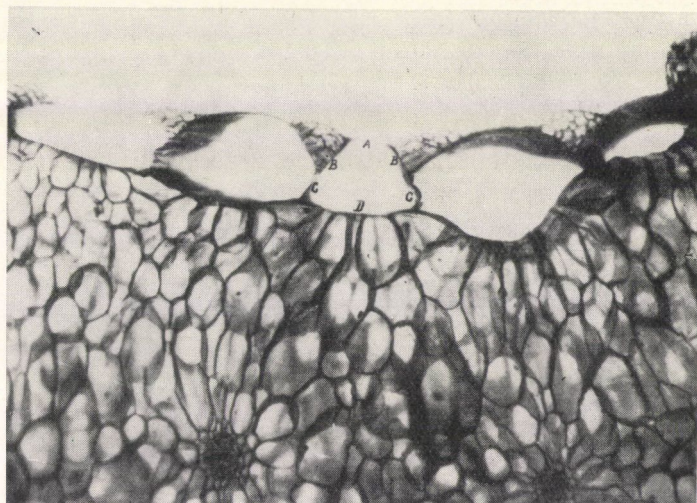


Fig. 1. Cross-section of the pericarp with giant cells. *A, B, C, D* the parts in the wall of the giant cell being in touch with different types of cell. (Particulars in the text.) Magnification $\times 25$



Fig. 2. Part of the wall of the giant cell is in contact with the inner epidermis of the pericarpium (Region "A"). Phase contrast microscope, magnification $\times 250$

cell wall will be marked with "A". On two sides of this region there are small-sized parenchyma cells being wedged in between two-two giant cells up to a certain depth. These cell wall sections are marked "with B". Now follows such a section of the giant cell wall where the giant cells are in direct touch with one another: this is region "C". To the side of the giant cell facing the interior of the pericarp, there are attached parenchyma cells of larger size; this region is marked with "D".

Further on, we are going to furnish information on the structural peculiarities of the giant cell wall as observed in the phase contrast microscope, in the sequence of the previously mentioned regions.

The most conspicuous feature of region "A" is that in the structure of the giant cell wall there becomes apparently visible, having the shape of a darker pattern, the spot where the radial walls of the thick-walled epidermis cells are fitted (Fig. 2). This fact indicates a close adherence to the giant wall and

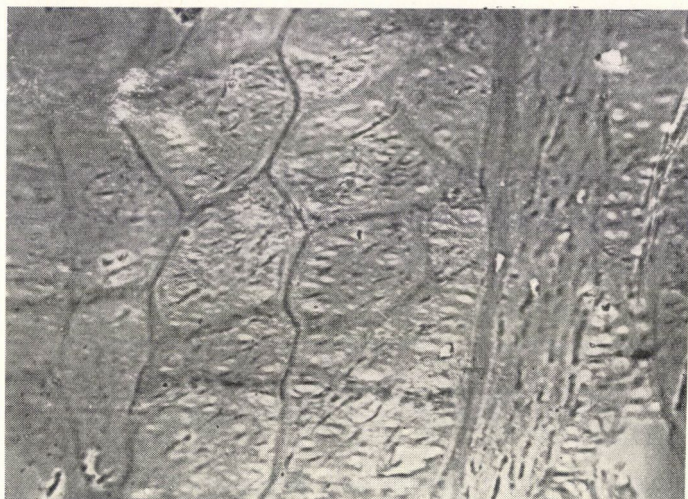


Fig. 3. Part of the giant cell wall being in touch with the smaller parenchyma cells (Region "B"). Phase contrast microscope, magnification $\times 150$

that the growth and differentiation of the adjoining wall sections have occurred simultaneously. In region "A" the number of the small foveolae is remarkably low; the foveolae are small (with diameters of 2–4 microns) and some circular-shaped. Accordingly between the giant cell and the epidermis cells only a slight relationship seems to exist.

In region "B", the pattern showing the fitting of adjoining cells can also be observed (Fig. 3). This is a network surrounding polygonal spaces indicating that here smaller isodiametrical parenchyma cells have bordered the giant cell. The lines forming polygonal pattern being now darker in the phase contrast microscope indicate that on these spots the cell wall is thicker and more compact. In the interior of the polygonal spaces, on the other hand, the wall of the giant cell is considerably thinner and numerous small foveolae appear, rather densely, there. The foveolae are markedly oval and in relation to the longitudinal axis, are always elongated in transversal direction. Their size is varied, the longer diameter might be of 2–20 microns. In the interior of the larger foveolae, however, a network structure can be seen already indicating

that these are not typically simple foveolae. In such a case we might speak of a compound foveola the more complicated structure of which is being differentiated in the course of the development and growth of the cell wall. Such formation of the cell wall region indicates that a good deal of plasmic connections with the adjoining cells have occurred here.

Along region "C" the giant cells are in direct contact with one another. This region is 80–100 microns broad and is situated in a belt-like manner in

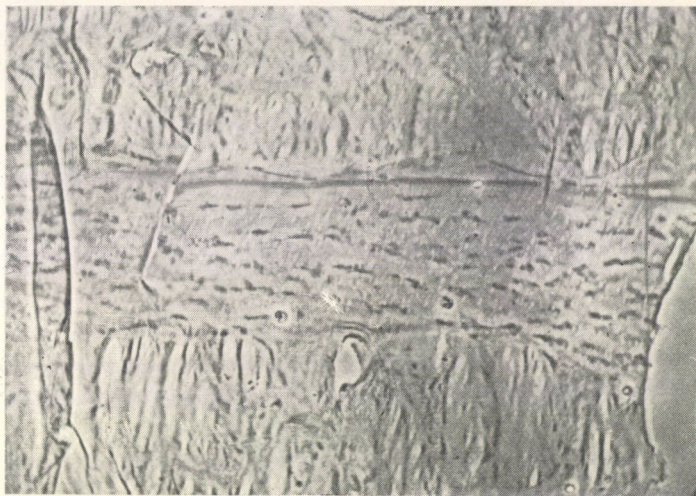


Fig. 4. Region of the giant cell wall being in contact with the neighbouring giant cell (Region "C"). Phase contrast microscope, magnification $\times 250$

the equatorial zone of the cell wall (Fig. 4). When examined in phase contrast microscope, it is divided sharply from the adjoining regions. In what it differs from these is that it contains very small foveolae in rather large number with diameters of 2–4 microns. However, these small foveolae are also oval being elongated perpendicularly on the longitudinal axis of the cell. Besides, there appears a broken-line dark pattern running parallel with the longitudinal axis showing, most probably, the local thickening of certain parts of the cell wall.

In region "D", where the giant cell is in contact with the bigger parenchyma cells of the pericarp, an extensive foveolate feature can be found as a characteristic one. (Fig. 5.) Here, too, the foveolae are oval and are transversally elongated as against the longitudinal axis of the cell. Some of the foveolae are compound being remarkably big, with diameters of 50–60 microns. In some cases the compound foveolae form definite groups and the groups themselves are oval (Fig. 6). The unusually big size and the complicatedness of the foveolae might be due to the fact that in this region the giant cell is in

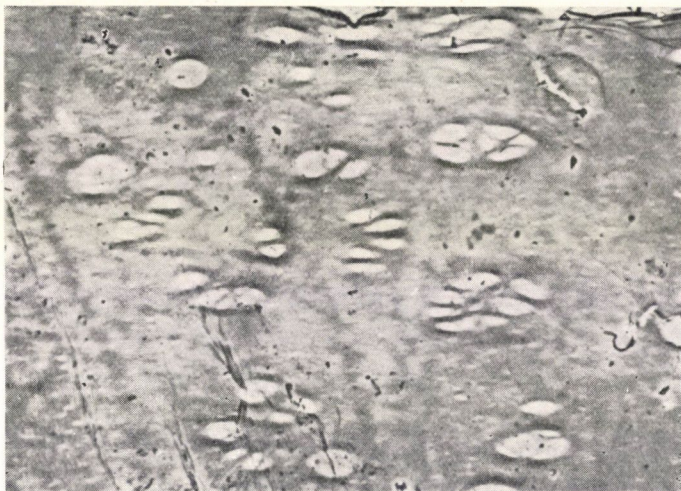


Fig. 5. Part in the wall of the giant cell facing the interior of the pericarp ("D" Region). Phase contrast microscope, magnification $\times 250$

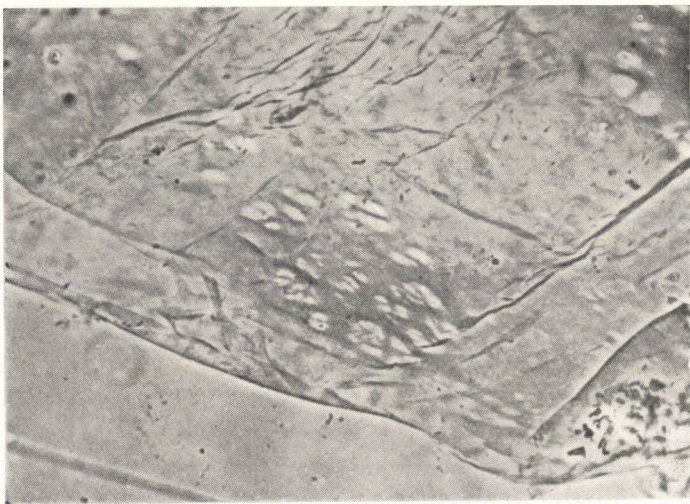


Fig. 6. Foveola-group developed from compound foveolae. Phase contrast microscope, magnification $\times 150$

touch with conspicuously big parenchyma cells in the walls of which big wall-particles may get perforated. Accordingly, the plasmic connections of the giant cell get mostly developed towards the interior of the pericarp; — a circumstance that most probably manifests itself also in the intensity of material transport.

After having expounded the structural peculiarities of the regions, we should like to stress that in some cases, we succeeded in dividing the wall of



Fig. 7. Section of the cell wall in the giant cell; the outer layer of the wall had partly been removed



Fig. 8. Section containing the B, C, D, regions in the wall of the giant cell between crossed nicols in polarizing microscope, magnification $\times 100$

the giant cell into two layers (Fig. 7). That statement is to be stressed because in the case of normal parenchyma cells, the secondary thickening of the cell wall used to be a matter in dispute. (PRESTON 1938; FREY—WISSLING 1942). Later the secondary thickening could be proved by electron microscope examinations in the parenchyma cells of *Avena coleoptyl* (WARDROP—CRONSHAW 1958). The dividability in the wall of giant cell indicates the existence of a cell wall layer being formed secondarily.

According to polarizing microscope studies, the wall of giant cell is almost everywhere of negative character which indicates that the cellulose microfibrils are arranged transversally as against the longitudinal axis of the cell (Figs. 8 and 9). That establishment is equally valid for the inner and outer layer of the cell wall. This peculiarity of the submicroscopic structure explains the oval form and the transversal elongation of the foveolae. Only

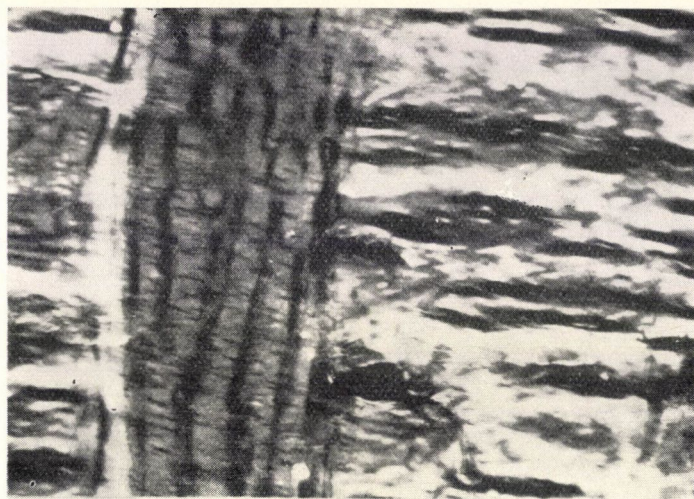


Fig. 9. Regions C and D in the wall of the giant cell in polarizing microscope, among crossed nicols, magnification $\times 200$

region "A" showed to be optically isotropic indicating the irregular arrangement of microfibrils. With that circumstance one can render parallel the fact that the foveolae being here, are circular shaped.

Thus, it can be established that the formation of wall structure at the giant cell is in close connection with the neighbouring cell and tissue types, respectively, and the four types of the adjoining cells are manifested in the wall of giant cell by the differentiation in four kinds of structure (Fig. 10).

Conclusions

The extremely large, so-called giant cells in the pericarp of *Capsicum annuum* L., being visible also to the naked eye, touch on their different sides with various, altogether 4 kinds of cell and tissue types, respectively. Accordingly, in the wall of giant cells concerning light microscopic structure, four regions can be detected which differ from one another mainly in their foveolate character. The heterogeneity of the differentiation of the cell wall indicates that the plasmic relationship taking place between the giant cells and the

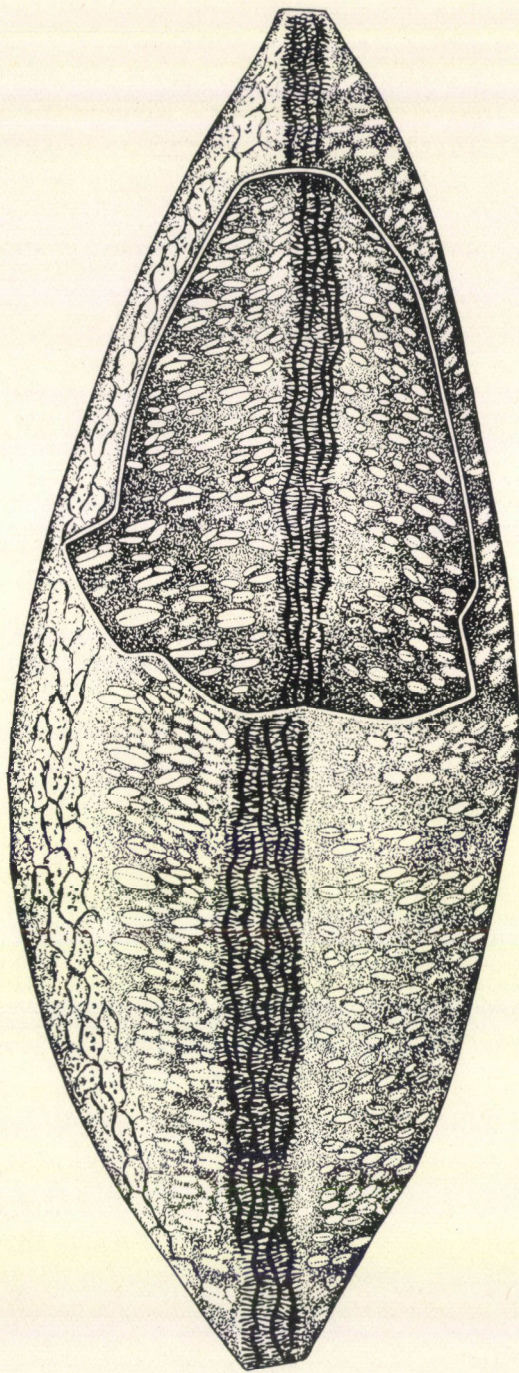


Fig. 10. Rough stereoscopic sketch of the giant cell, magnification $\times 100$

different types of neighbouring cells is different. This latter circumstance calls forth the diversity in material transport. The wall of the giant cells can be divided into two layers indicating a secondary thickening of the cell wall. The submicroscopic structure of the wall of the giant cells is characterized by the fact the cellulose microfibrils got orientated perpendicularly on the longitudinal axis of the cell. In the course of polarizing microscope examination, this structure manifests itself in optically negative character. The oval shape and organized settling of the foveolae are explained by the transversal arrangement of the cellulose microfibrils.

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A NOTE ON SOME SCALE INSECTS (HOMOPTERA, COCCOIDEA) OF THE HUNGARIAN FAUNA

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During her stay in Hungary in September 1964, the author collected 16 species of scale insects in the neighbourhood of Tompa and in Budapest; 9 of them proved to be new for Hungarian fauna, 2 new to science. The latter will be described in a separate paper. The list of species given takes into consideration biological data, time, host plants, and development stage.

Introduction

The author's investigations concerned chiefly scale insects living on herbaceous plants as she expected to find species not hitherto collected in Hungary. The sandy area in the neighbourhood of Tompa indicated by J. ERDŐS proved to be especially interesting. 15 species were collected there and only one in Budapest.

Out of the collected material microscopic preparations were made using the generally accepted methods. The identification was checked by the author during her stay in the Leningrad Zoological Institute. Preparations of scale insects new for Hungary will be given to the Zoological Museum in Budapest. The given data on the appearance of scale insects in Hungary are based on the publications by KOSZTARAB (1955, 1956, 1959) and ERDŐS (1957). The identification of species and their distribution in Europe are based on the literature given in the References.

List of Species

The following gives the date of collecting, location, host plant and the development stage of each species. Species new for Hungary are marked with an asterisk.

Family: *Pseudococcidae*

1. *Trionymus aberrans* GOUX*

host: sheaths of *Agropyron repens* (L.) P. B. and *Stipa capillata* L.

loc.: Tompa, 9 Sept. 1964 — numerous larvae and ♀♀; Ásotthalom

Emlékerdő, 11 Sept. 1964 — several ♀♀ parasite infested.

This species has been hitherto reported from France, the U.S.S.R (BORCHSENIUS 1949), Germany (SCHMUTTERER 1952a), and Poland (Koteja, Žak-Ogaza in print). *Festuca pratensis* Huds., *Briza media* L., are the known hosts for the species.

2. *Mirococcopsis stipae* BORCHS*

host: sheaths of *Stipa capillata* L.

loc.: Ásotthalom, Emlékerdő, 11 Sept. 1964 — several ♀♀.

The species described from Southern Armenia was collected on *Stipa* sp. (BORCHSENIUS 1949).

3. *Mirococcus clarus* BORCHS*

host: roots of *Festuca* sp.

loc.: Tompa, Zsiroskúti erdő, 10 Sept. 1964 — 2 ♀♀.

This species described by BORCHSENIUS from Dagestan in 1949 has not been reported hitherto from other territories. It was also collected on the roots of *Festuca* sp.

4. *Heterococcus borchsenii* MORR*

host: sheaths of *Setaria viridis* L. and *Agropyron repens* (L.) P. B.

loc.: Tompa, 13 Sept. 1964 — numerous larvae and ♀♀.

Until recently this species has been known as occurring only in the U.S.S.R. (Tombovski region, Ukraine, Northern Caucasus) (DANZIG 1964). Then it was recorded in Poland (ŽAK-OGAZA, KOTEJA 1964). *Briza media* L., *Dactylus* sp. are the known hosts for the species.

Family: *Eriococcidae*

5. *Rhizococcus insignis* (NEWST.)*

host: dry twig

loc.: Budapest, 7 Sept. 1954 — 2 ♀♀ in ovisacs.

This species widespread in Europe, has been collected on numerous species of plants such as *Calamagrostis*, *Poa*, *Agropyron*, *Carex*, and *Luzula*.

6. *Rhizococcus cynodontis* (KIRICZENKO)*

host: leaves and stalk of *Cynodon dactylon* L.

loc.: Ásotthalom, Emlékerdő, 11 Sept. 1964 — numerous larvae, ♀♀ just before forming ovisac, and white male puparia.

This species described in 1940 from Crimea was afterwards collected also in Armenia (DANZIG 1962). HOY (1963) reported it, following BORCHSENIUS

(1949) as a synonym of *Rh. insignis* (NEWST.). This error probably resulted from the fact that he did not know DANZIG's paper of 1962 in which that author again separated the two species.

The species has been hitherto collected only on leaves of *Cynodon dactylon* L. so it seems to be monophagous.

7. *Greenisca glyceriae* (GREEN)*

host: sheath of *Festuca* sp.

loc.: Ásotthalom, Emlékerdő, 11 Sept. 1964 — 1 ♀.

This species is relatively widespread. It was reported from England (GREEN 1921), France (GOUX 1937), Germany (SCHMUTTERER 1952), Czechoslovakia (ZACHRADNIK 1959), the U.S.S.R. (Leningrad region, Ukraine, Crimea) (DANZIG 1964), Poland (ŽAK—OGAŻA, KOTEJA 1964). It lives on numerous species of grass.

Family: *Asterolecaniidae*

8. *Asterolecanium variolosum* (RATZ.)

host: *Quercus* sp.

loc.: Tompa, Zsiroskúti erdő, 10 Sept. 1964 — numerous ♀♀.

The species is widespread. It has been reported from numerous localities in Hungary (KOSZTARAB 1955, 1956, 1959).

Family: *Coccidae*

9. *Lecanopsis festucae* BORCHS*

host: roots of *Festuca* sp.

loc.: Ásotthalom, Emlékerdő, 11 Sept. 1964 — several third instar larvae.

This species described in 1952 has been collected hitherto in the U.S.S.R. (Ukraine, Crimea, Northern Caucasus) (BORCHSENIUS 1952) on the roots of *Festuca* sp. and under stones.

10. *Parafairmairia delicata* BORCHS*

host: stalk of *Stipa capillata* L.

loc.: Ásotthalom, Emlékerdő, 11 Sept. 1964 — 1 ♀ with deposited eggs.

This species described in 1952 from the U.S.S.R. (Latvia and Leningrad region) (BORCHSENIUS 1957, DANZIG 1959) has not been hitherto reported from other parts of Europe. It also occurs on *Carex* sp.

11. *Eriopeltis festucae* (FONSC.)

host: stalks of *Festuca* sp.

loc.: Ásotthalom, Emlékerdő, 11 Sept. 1964 — several live ♀♀ in ovisacs during oviposition.

This species widespread in Europe has also been reported from numerous localities in Hungary (KOSZTARAB 1955, 1956, 1959, ERDŐS 1957).

Family: *Diaspididae*12. *Leucaspis loewi* COLVÉE

host: *Pinus silvestris* L.

loc.: Ásotthalom, Emlékerdő, 12 Sept. 1964 — numerous second instar larvae and ♀♀.

This widespread species has been reported from numerous localities in Hungary (KOSZTARAB 1956, 1959).

13. *Chionaspis salicis* (L.)

host: *Populus tremula* L.

loc.: Ásotthalom, Emlékerdő, 12 Sept. 1964 — numerous ♀♀.

The species is widespread in Europe, and known from various regions of Hungary (KOSZTARAB 1956, 1959).

14. *Quadraspidotus gigas* (THIEM., GERNECK)

host: *Populus tremula* L.

loc.: Ásotthalom, Emlékerdő 12 Sept. 1964 — numerous ♀♀ with deposited eggs.

The species is widespread in Europe, reported from various places of Hungary (KOSZTARAB 1955, 1956, 1959).

Conclusion

To sum up, on the basis of KOSZTARAB's publications (1955, 1956, 1959), the number of scale insects known from Hungary, it may be said that the number of 73 species (not including glass-house species) reported up till 1959 has now been increased to 82. Out of 9 species new for Hungary 4 belong to the family *Pseudococcidae*, 3 to the *Eriococcidae* and 2 to the *Coccidae*. 2 species new to science belong to the genera *Trionymus* BERG. and *Atrococcus* GOUX.

Besides determining scale insects new for the Hungarian fauna the information concerning the occurrence and biology of several little known

species has been enlarged and enriched. Thus for example the *Mirococcus clarus* BORCHS., *Mirococcopsis stipae* BORCHS., *Rhizococcus cynodontis* (KIRI-CZENKO), *Lecanopsis festucae* BORCHS. and *Parafairmairia delicata* BORCHS. have been determined for the first time outside the U.S.S.R.

Stipa capillata L. has proved to be a very interesting host: 4 species of two different families have been determined on it.

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BIOCHEMICAL PROCESSES OF VERNALIZATION

V. FORMATION AND LOCALIZATION OF RIBONUCLEASE I.

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The conditions of localization and formation of ribonuclease I supposedly taking part in the process of vernalization, have been studied. It has been established that ribonuclease I which is produced under colt effect, gets localized in the thalamus tip and its activity develops in homogenate and in two steps. It has also been proved that for its formation, several components have to be present simultaneously, among others a protein basis and an enzyme or an enzyme system. The ribonuclease I activating system is active at a temperature around 0°C, and with the synthesis of ribonuclease I it takes part in the metabolism of vernalization.

Introduction

In our previous paper (DÉVAY, 1965) we proved that the biochemical mechanism of vernalization was partly bound to nucleic acid metabolism. In the course of vernalization specific proteins get synthesized, among others a form of RNase taking part in RNA metabolism and being very active even at low temperature (0°C). On the basis of the temperature and inhibitory conditions of its formation, this RNase called by us RNase I, is likely to take part directly in vernalization metabolism. In our present paper we want to report on our further investigations concerning the formation and localization of RNase I.

Material and Methods

For preparing the experimental plant material the seeds of winter wheat B 1201 had been swelled for 12 hours and then, after sterilizing with sterogenol germinated at 20°C for 36 hours (36-hour embryos). In the case of vernalization the seed material thus prepared had been kept in refrigerator at a temperature of 0°C for the time required.

According to the character of investigations, the embryos were isolated from untreated seed material or from a material that had been vernalized for 14 days, and were then homogenized in 0.01 M pH 6 citrate buffer.

For studying green plant material, after swelling, germinating and vernalizing, respectively, the seeds were put into perlite and then, when sprouting, the seedlings were raised on a Knop culture-fluid being supplemented with A—Z solution in an air conditioned chamber, illuminated artificially and at 8-hour daily light, at 12°C for 20 days. By this time the first leaf of the seedling was quite developed, the second was semi-developed, but the tip of the third leaf was not yet visible. After the 20 days had elapsed, the seedlings were washed out of the perlite and then the shoot-tip, the first leaf and the roots were isolated. From these

organs a homogenate was prepared with 0.10 M citrate buffer, pH 5.6 and this was used for our further studies.

Pre-incubation: The aim was the formation of RNase in homogenate. The homogenate was kept for the suitable time, as shown in the Tables, in refrigerator at 0°C. Under aerob conditions, from time to time (every 30 minutes) air was bubbled through the homogenate, while under anaerob conditions, what had previously been boiled out thoroughly, was homogenized in buffer and the homogenate was cut off the air.

Fractionation of protein with $(\text{NH}_4)_2\text{SO}_4$. 2500 untreated, 36-hour old seedlings were homogenized in 200 ml 0.01 M citrate buffer, pH 6, then, with cooling, ammonium sulfate was added gradually to the solution in a quantity so as to obtain a saturation of 20%. Once the precipitate had been separated, the ammonium concentration was raised gradually to 30, 45, 60 and 80% and the precipitates being separated at the different levels, were centrifuged and dissolved in 50 ml 0.01 M pH 6 citrate buffer separately. The precipitates of the fractions were condensed in refrigerator at 0°C, for 6 hours.

Determination of RNase activity. The activity of RNase was determined in spectrophotometric way relying on basis-release. As substrate yeast nucleic acid of 0.2% was used that had been previously purified by repeated precipitation. 1 ml homogenate (with a protein content of about 10 mg) was measured into the centrifuge tube, then 1 ml 0.2% solution of RNA in 0.1 M citrate buffer, pH 5.6, was added. The temperature of both the homogenate and of the nucleic acid solution was set for 0°C. The unbreacked RNA was precipitated with hydrochloric ethanol of -10°C (100 ml cc HCl, 1000 alcohol of 96%). The precipitate had been condensed at -10°C for 60 minutes and then was centrifuged. The supernatant was diluted with water in 1 : 5 ratio (2 ml supernatant, 10 ml water). The quantity of liberated bases was measured with spectrophotometer at 260 millimicron, and evaluated on the basis of the standard curve. Parallely the quantity of soluble protein was determined and the activity values indicated in the broken up γ RNA/100 mg protein/60 minutes relations. Errors of the determinations did not exceed the \pm 2.5 per cent. Naturally, in the means of biological repetitions absolute values show greater oscillation, however, changes can always be reproduced with identical character. In our conclusions, disregarding the numerical values of the biological repetitions, only the character of alterations have been evaluated.

When applying inhibitors and dehydroascorbic acid (DHA), chemicals were brought into homogenate in the amounts as shown by the Tables. In the case of DHA, taking into consideration the decomposition of the chemical, the quantities presented in the Tables indicate only those introduced and not the DHA concentrations being actually present. Direct DHA determinations were not performed.

Results and Discussion

a) Localization of RNase I

In our previous work (DÉVAY, 1965) we evinced the presence of RNase I in the vernalizing B 1201 embryos. Now we have examined that in which organ of the seedling and of the young wheat plant with two leaves, respectively, the developing enzyme is being localized. The results of our experiments are summarized in Table 1.

The 36-hour embryos were separated into two parts, the radicle and the plumule containing also the shoot-tip. When being untreated, in neither of them could activity be proved while in the case of embryos being vernalized for 14 days, activity appeared in the plumule. In the green seedlings being untreated, no RNase activity could be proved at the shoot-tip at 0°C. With seedlings vernalized for 14 days, high-degree activity could be proved in the shoot-tip. In the 1st leaf and the root no activity could be observed.

Table 1

*Localization of RNase I in the 36-hour wheat embryo
and in seedlings with two leaves*

The state of the plant	Part of the plant	Activity	
		Vernalization 0 day	Vernalization 14 days
36-hour embryo	plumule	—	982
	radicle	—	—
Seedling with two leaves	shoot-tip	—	9.200
	first, developed leaf	—	—
	root	—	—

Treated plant material: 36-hour embryo and seedling with two leaves. Detailed description in „Material and Methods”

Homogenate: 10 mg protein per ml in 0.10 M citrate buffer, pH 5.6. In the case of the thalamus tip: 5 mg protein per ml

Determination of RNase activity: Incubation 60 min., at 0°C; for particulars see: „Material and Methods”

Activity: gamma RNA/100 mg protein/60 min.

Cold-effect has produced RNase activity and the formation of enzyme activity only in shoot-tip and plumule if the latter contained the shoot-tip, too. Thus, RNase I appearing under cold-effect and being very active at 0° C, is localizing in the shoot-tip.

b) Formation of RNase I in homogenates

Preliminary experiments have proved that the activity of RNase I might be brought about to a certain degree at low temperature (0° C) also in homogenate viz., enzyme activity does appear in homogenates kept at a temperature of 0° C. We have had, therefore, further investigations on the conditions of the initial development of RNase I, the results of which are summarized in Table 2.

In the Table it can be well observed that in the homogenate marked with “Control”, the RNase activity is forming in two steps. The first one comes into existence in the 0—4 hours of pre-incubation, while between 4—8 hours the formation of the second step can be observed. After the 8th hour of pre-incubation the activity is quickly diminishing, most probably as a result of secondary processes. Therefore, further evaluation had to be closed up by the 8th hour of incubation.

The application of 2.4 dinitrophenol (DNP) had had no effect on the formation of the first step, while the second one has utterly dropped out. A similar phenomenon can be observed also in the presence of AgNO₃ or Hg-acetate. DHA kept in low concentration (20 γ/ml), does stimulate the for-

Table 2
Formation of RNase I in homogenate

Inhibitor	γ /ml end-conc.	Activity after						
		0	2	4	6	8	10	24
		-hour preincubation						
Control		—	200	208	340	340	140	70
DNP	50	—	200	260	180	160	40	40
ATP	50	—	180	200	320	300	130	80
DHA	20	—	190	210	430	450	150	90
DHA	200	—	—	—	—	—	—	—
DHA	400	—	—	—	—	—	—	—
AgNO ₃	25	—	160	220	120	100	100	80
Hg-acetate	250	—	190	210	80	—	—	—

Treated plant material: 36-hour unvernalized embryo.

Homogenate: 10 mg total protein per 1 ml in 0.01 M citrate buffer, pH 6.

Preincubation: 0, 2, 4, 6, 8, 10 and 24 hours at 0°C in the presence of compounds mentioned for rendering possible the formation of RNase I. This preincubation was followed by the determination of enzyme activity.

Determination of RNase activity: Time of incubation 60 min., at 0°C. Particulars in "Material and Methods".

Activity: gamma RNA/100 mg protein/60 min.

Aerob conditions.

Table 3

Effect of dehydroascorbic acid on the formation of the RNase I under aerob and anaerob conditions, in homogenate

DHA conc./ ml.	Activity after							
	0		3		8		24	
	-hour incubation							
	a	b	a	b	a	b	a	b
0	—	—	126	120	200	110	90	40
12	—	—	140	130	300	120	70	50
25	—	—	130	128	550	100	20	40
50	—	—	130	130	350	120	30	40
100	—	—	—	—	—	—	—	280

Treated plant material: 36-hour embryo.

Homogenate: 10 mg total protein per 1 ml in 0.01 M citrate buffer, pH 6.

Preincubation: 0, 3, 8 and 24 hours at 0°C, in the presence of different quantities of DHA, to render possible the formation of RNase I. — Preincubation was followed by the determination of RNase I activity.

Determination of RNase I activity: Time of incubation 60 min, at 0°C; for particulars see: „Material and Methods”

Activity: gamma RNA/100 mg protein/60 min.

a; under aerob conditions, b; under anaerob conditions.

mation of the second step, but proves to be ineffective with the first one. In higher concentration it thoroughly inhibits the formation of RNase.

The effect of varying DHA concentrations is interestingly shown by Table 3. In it we have illustrated, applying different DHA concentrations, the formation of the first and second activity steps under aerob and anaerob conditions.

The rise of DHA concentration without pre-incubation, does not produce enzyme activity. It has also proved ineffective on the formation of the first step (in case of applying 3-hour incubation) with an increase of DHA up to 50 gamma/ml concentration. While the second step is developing (8-hour incubation), under aerob conditions, the increasing quantity of DHA has — on the basis of the max. curve — a marked influence on the formation of activity. The maximum has appeared with 25 gamma/ml concentration. Anaerob conditions have no influence on the formation of the first step, while they entirely inhibit the developing of the second step.

On the basis of the applied inhibitors and DHA as well as of the aerob and anaerob system, the formation mechanism of the two steps is, presumably and partially, different. VENETIANER—STRAUB (1965), KRAUSE—VENETIANER—STRAUB (1965) have proved that in pigeon pancreas there can be evinced an enzyme activating the reduced RNase. Only in the presence of DHA can that enzyme exert its effect, though the high DHA concentrations inhibit its activity, and DHA is not likely to be the coferment of that particular enzyme. In the authors opinion, DHA can first function as oxidizing agent, transforming the developed SH groups into S—S bonds. The enzyme activity, on the other hand, consists of settling suitably the S—S bonds that had developed due to faulty oxidations, and thus, of the evolving of RNase activity. They presume that RNase activation might be accomplished similarly also under natural conditions, starting from the reduced or oxidized protein chains.

It can be assumed that in our case the protein basic molecule of RNase I must have been present, in very small quantities, both in oxidized and in reduced form, before the start of vernalization, and it first developed from oxidized molecules rendered stable with S—S bonds, and then in the second step, from the reduced-type SH-base protein. This might be an explanation for the fact that the formation of the first step was influenced neither by anaerob conditions, nor energy-transport, nor the inhibitors of the SH group, while on the other hand, the same exerted an obvious influence on the formation of the second step. For the formation of the first step no oxygen is needed. The more important is its role with the formation of the second step, where it cannot be replaced with the addition of DHA. The second step has come into being in the presence of dehydroascorbic acid but under anaerob conditions, it has failed to come about. DHA can exert its effect only in the presence of oxygen and thus, the idea of Venetianer and co-workers, so (1965) as to establish direct contact between SH and the oxygen of the air, seems to be relevant.

c) Examining the RNase I activating enzyme and the basic protein

On ground of what had been said previously, it could be assumed that RNase I started from some base-protein in one or more steps, and this process was rendered possible by a temperature around 0° C. So the question arose whether this activating from the base-protein was of enzymatic character? As to decide the problem, we have examined the RNase activity of proteins precipitating at different $(\text{NH}_4)_2\text{SO}_4$ saturation levels after 6 hours of preincubation. The solutions of protein fractions have been mixed also with one another, thus trying to disclose whether the activating system consists of one or of two components. Our results are shown in Table 4.

Table 4
Formation of the activity of RNase in different protein fractions

$(\text{NH}_4)_2\text{SO}_4$ saturation %	20	30	45	60	80
20	—	—	—	—	—
30	—	—	—	257	35
45	—	—	—	—	—
60	—	257	—	—	—
80	—	35	—	—	—

Homogenizing: in 0,01 M citrate buffer, pH 6; 2500 36-hour untreated embryos in 200 ml buffer.

Fractionation: The whole material fractionated with NH_4_2SO_4 . The given saturation levels were set with stable ammonium sulphate. In order to get the precipitate separated, the solutions were placed into refrigerator for 6—6 hours at 0° C. The precipitated protein fractions were dissolved each in 50 ml 0,01 M citrate buffer, pH 6.

Preincubation: The solution of the precipitates getting separated at different saturation levels, were admixed in quantities of 5—5 ml. With each variant 250 gamma DHA was added to the solutions; incubation was carried out for 6 hours under aerob conditions so that RNase I might develop. The determination of the RNase I activity took place after preincubation.

Determination of RNase I activity: Time of incubation 60 min., at 0° C. Particulars in: "Material and Methods".

Activity: (numerical value given in the Table) gamma RNA/100 mg protein/60 min.

Without preincubation with none of the fractions was found activity. — = 0 activity.

In the Table we have illustrated the RNase activity of the precipitates being separated at different ammonium sulfate level and measured at 0° C. When having mixed protein-solutions, RNase activity did not appear more than twice after preincubation. High activity developed at the 30% saturation level, and when mixing the protein solutions that had precipitated at the 60% saturation level, while a lower appeared at mixing the proteins of the 30%-and 80% levels. The solutions of proteins precipitating at these saturation levels, did not show activity by themselves, therefore, it was presumable that only the two fractions together contained the components needed for the formation of the

active enzyme. We have succeeded in evincing the finding that for the formation of the active RNase, at least two components are required, most probably a base-protein and an enzyme, still on the basis of the above, we have failed to find out in which fraction these could be available.

For further elucidation of the problem, — availing ourselves of the observations of KRAUSE—VENETIANER—STRAUB (1965) according to which DHA oxidizes the reduced ribonuclease that can now be activated by the enzyme without the presence of DHA, — we assumed that when adding DHA separately to the fractions previously, it would be possible to decide, after having removed DHA, that in which fraction we might reckon with the presence of the base-protein and in which of the eventual presence of the activating enzyme. Thus, after fractionation, to the half of each solution 125 gamma/25 ml DHA was added, then precipitating was repeated in order to obtain the oxidized component free of DHA; then the proteins treated with DHA and precipitated at the 30 and 60% saturation level, were again reacted with one another in DHA-free medium. The results are shown in the data of Table 5.

Table 5

Effect of DHA treatment on the RNase activity of proteins getting separated at 30% (I) and 60% (II) saturation levels

Treatment	Activity
I—II	98
I—II (DHA)	92
I—(DHA)—II	163
I—(DHA)—II (DHA)	169

Homogenizing: in pH 6 0.01 M citrate buffer. — 2500 unvernallized embryos in 200 ml end-volume.

Fractionation: The whole material fractionated. First the solutions were saturated with ammonium sulfate to a 20% saturation level. After the separation of the precipitate centrifuging was performed. The saturation level was then raised to 30%; the fraction separating then is Fraction I. After separating Fraction I, the saturation level was raised to 45%, and following the separation of the precipitate, centrifuging was performed. After centrifuging the saturation level of the supernatant was raised to 60%. The fraction getting now separated, is Fraction II. The two fractions were dissolved in 50 ml 0.01 M citrate buffer, pH 6, and the solutions were then halved.

Treatment with DHA: We added to the buffer-solution of the precipitates I and II 125 (25 ml DHA. We let it stand up for an hour in refrigerator at 0° C, then the required saturation levels setting repeatedly with ammonium sulfate, the proteins were precipitated. As done after the first fractionation, it was turned into solution.) The marking DHA in brackets after the Roman numerals show the dehydroascorbic acid treatment.

Preincubation: 5—5 ml of fractions I and II treated and untreated with DHA were mixed and preincubated under aerob condition for 6 hours at 0° C. RNase activity was determined from the preincubated mixture.

Determination of RNase U activity: Incubation time 60 min.; particulars in: "Material and Methods".

Activity: The numeric value shown in the Table, gamma RNA/100 mg protein/60 min.

With the proteins separating at the 30% saturation level, a previous DHA treatment resulted in an intensive increase of RNase activity forming due to pre-incubation. The DHA treatment of proteins precipitating at the 60% saturation level, did not enhance the activity in the case when the pre-incubation partner was the protein separating at 30% saturation level still not being treated by DHA. From all these data we might conclude that both the oxidized and reduced (oxidizable with DHA) base-proteins are among the proteins precipitating at the 30% saturation level, while the activating enzyme or enzyme-system are among those separating at the 60% saturation level. Thus, we have managed to render plausible, also in plants, the existence of a system, similar to the RNase activating system of animal organism. Unfortunately, our efforts concerning the isolation of the individual components, have not yielded results so far.

By bringing about the active form of RNase I, the RNase activating system takes most probably a direct part in vernalization as an essential edement of the latter. Part of the base protein serving for the synthesis of RNase, — at least as much as is needed for initial enzyme formation, — gets synthesized during germination and therefore, in our opinion, the start of germination is necessary for the receipt of vernalization stimulus. Later, during vernalization there ensues a probable re-synthesis of the base-protein. In our previous publication (DÉVAY, 1965) we established that the increase of RNase activity did not occur when applying protein and nucleic acid inhibitors; we, therefore, come to the conclusion that here the formation of active enzyme was the result of the protein synthesis process taking place in vernalization. In our present examinations it has been proved that a small part of both the base-molecule needed for the formation of active RNase molecule and the activating enzyme or enzyme system are formed during germination, while their major part gets already synthesized in the course of vernalization.

The formation of the active RNase I molecule, however, is a process brought about by cold-effect. Table 6 illustrates these conditions. Here chloramphenicol and 2,4 dinitrophenol have been added partly right after swelling, partly in the 24th hour, and the formation of enzyme activity was measured in the first 12th hour of cold-treatment and then on the seventh and 14th day.

The data of the Table show that only 10% of the max. enzyme activity measured on the 14th day, is being formed in the first 12 hours of cold-treatment. There appears some difference between the effect of inhibitors applied at the time of swelling and in the 24th hour of germination i.e. 12 hours before the start of cold-treatment. When applying chloramphenicol in the 24th hour of germinating, 81.9 and, in the case of DNP, 50.8% activity will appear, while the effect of inhibitors applied at the time of swelling, is substantially greater. If we consider that in the first 12 hours only about 10% of the max. activity developing in the second week, will appear and DNP applied at the time of

Table 6

The formation of RNase I activity when applying chloramphenicol and dinitrophenol inhibitors

Variant		Vernalization					
		12 hours		7 days		14 days	
		activity	%	activity	%	activity	%
Control		1.2	100	4.8	100	12.2	100
Chloramphenicol	a	0.3	25.0	1.2	25.0	3.9	31.9
	b	1.0	81.9	2.5	52.0	4.1	32.0
2.4-DNP	a	0.1	10.0	0.3	6.9	1.0	8.1
	b	0.7	50.8	0.9	19.1	1.6	13.1

Application of inhibitors: Chloramphenicol 0.10% 2.4-dinitrophenol (DNP) 0.01 a: applied at the time of swelling b: applied in the 24th hour of germination

Determination of homogenization and enzyme activity. See in: "Material and Methods".

Activity: gamma RNA/mg protein/60 min.

swelling causes 90% inhibition, while that being added in the 24th hour of germination causes but 50% of inhibition, — on ground of the above, we might suppose that only about 10% of the RNase I base-protein could have been synthesized in the course of germination and 90% was being formed, presumably, during vernalization. In view of the fact that, as previously proved, DNP inhibited only the second activity that had presumably started from SH protein, on the basis of the 50.8% inhibition as compared to the control, we may suppose that about 50% of the base-molecules getting synthesized during germination, is present in the form of S—S protein.

Naturally, the developing enzyme activity inhibitions, under the effect of chloramphenicol, DNP, acridine orange and tripaflavine applied in the course of vernalization, one result of which was also the decrease of RNase I activity (DÉVAY 1965), cannot be confined exclusively and entirely to the protein base molecule. The inhibition of the synthesis of the activating enzyme is also possible. The elucidation of the latter and of the relations between the protein base molecules getting synthesized during germination and vernalization, will be the subject of our further investigations.

According to our present hypothesis, RNase I gets formed through the contribution of a base-protein, an enzyme or enzyme systems. This development is a process needing a considerable quantity of oxygen which explains, among others, the oxygen-sensibility of vernalization processes.

It is questionable whether the base protein is suitable, specifically, for the formation of RNase I, and whether the other RNase systems in the wheat embryo (DÉVAY, 1965) are brought about by the same activating enzyme system. The elucidation of these problems requires further series of experiment.

Conclusions

Localization and conditions of formation of the RNase enzyme I, taking part presumably in the process of vernalization, have been studied in winter wheat B 1201.

We have established that the ribonuclease I brought about under the influence of cold-effect, gets localized in the shoot-tip. Up to a certain degree its formation gets accomplished also in homogenate at a temperature of 0 °C. The activity of RNase I develops in the homogenate in two steps. The development of the two steps is likely to occur on the basis of different mechanisms. At the beginning of cold-effect, the development of the first step is a process not requiring oxygen and is not influenced by SH inhibitors. The formation of the second step, however, is a process requiring a considerable quantity of oxygen and is not influenced by SH group blocks. In low concentration, DHA does stimulate the process. It has been evinced that for the development of RNase I the joint presence of several components is necessary, among others that of a protein base and an enzyme or enzyme system. Thus, we have succeeded in evincing the presence of RNase activating systems, that has been recently found in animal organism, also in plant organism.

The RNase activating system exerts its effect at a temperature around 0° C and takes part in the metabolism of vernalization.

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MORPHOLOGICAL AND CYTOLOGICAL CHARACTERISTICS OF A FEW HYBRID SPECIES OF *T. TIMOPHEEVI* ZHUK.

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The present study treats the morphological and cytological characteristics of the F_1 and succeeding generations of various hybrid species of *T. timopheevi* Zhuk. The plants of the first generation may be distinguished by their uniformity and intermediate character while the F_2 generation of the studied hybrid species shows an extremely great segregation. Extensive aberrations in reduction division were observed whenever there was a difference in both the genome homology and chromosome number of *T. timopheevi* Zhuk. and its parental pair.

Introduction

As it is generally known tetraploid *T. timopheevi* Zhuk. plays an important role in improving the resistance of wheat. The species found growing wild among the cultivated wheat of western Georgia in 1928 by ZHUKOVSKY, as well as *T. monococcum* L., are known throughout the world to be resistant to all diseases. Due to the difficulties of crossing it is not easy to transmit the immunity of this species to *T. aestivum* L. Breeding work is complicated by several of its unfavourable properties which can be eliminated by lengthy selection.

Most authors, among them KISS (1953, 1956), LELLEY (1953), PRIDHAM (1953), SKURIGYINA (1958), VAVILOV (1949), ZAHARJEVSKI (1950), etc., who studied crosses with *T. timopheevi* Zhuk. generally examined the intermediate character of F_1 hybrids. Certain authors (ISENBECK—ROSENSTIEL 1950, OEHLER 1956, SCHEIBE 1951 etc.) distinguish the true intermediate type from the apparent intermediate character in which only a part of the features are intermediate and one maternal parent becomes the dominant for certain morphological features. Since the plants inherit a part of the dominant features of both parents, they give the impression of an intermediate type.

Depending on the species used, the F_2 generation of crosses with *T. timopheevi* Zhuk. showed an entirely different segregation. Accounts of the great diversity of hybrid progeny obtained when crossing parental species of extremely diverse characteristics can be found in literature (RAJHÁTHY 1955, ČIKOV 1961, KISS 1953, VAVILOV 1949 etc.)

Another great hindrance in the further propagation of hybrid species of *T. timopheevi* Zhuk. is the large percentage of sterility occurring in the first and subsequent generations. In most instances this phenomenon is caused by meiotic aberrations.

Researches have intensively studied the chromosome pairing of hybrids originating from crosses of *T. timopheevi* Zhuk. with tetraploid series and with species having a different number of chromosomes (KIHARA 1934, KOSTOFF 1937a, b, SACHS 1953). WATANABE (1953) and WATANABE—MUKADE (1955) noted univalent, 1—2 trivalent and quadrivalent chromosomes in the meiosis (metaphase I) of F_1 hybrids of the *T. timopheevi* Zhuk. \times *T. aestivum* L. combination. WAGENAAR (1961) found, in addition to univalence, chromosome fragment in the meiosis of the *T. timopheevi* Zhuk. \times *T. durum* Desf. hybrid species.

This study will contain the morphological and cytological characteristics of only a few hybrid species of *T. timopheevi* Zhuk.

Material and Conditions

For crossing I have used *T. timopheevi* Zhuk. v. *typicum*, a variety which is characterized by being strongly pubescent.

In order to reach the theoretical and practical goals I crossed the *T. timopheevi* Zhuk. species primarily with *T. carthlicum* Nevski v. *stramineum*. *T. durum* v. *affine* and the *Vernal cultivar* of the *farrum* variety of *T. dicoccum* Schübl. species besides the better known varieties of *T. aestivum* L.

The F_1 and following generations of the planted hybrids were individually examined and studied.

In treating the laboratory results I shall include in the present study, from among the treated features and in addition to the characters of the heard types of hybrid species, a) the form of grains and angle of the germ, b) the form of the flume and its hairiness, the presence of awns, the size of the glume shoulder, its teeth, etc.

In addition to the number of chromosomes I took into account the meiotic aberrations (such as univalent chromosomes, chromatin bridges, chromosome fragments, chromosome rings etc.) during the cytological examinations. Microscopic preparations were made with the aceto-carminic quick method. Pollen was examined with a Lumipan microscope at a magnification of 10×8 . By fertile pollen I mean regular shaped pollen grains well-stained with aceto-carminic.

Results and Discussion

Morphological characteristics of hybrid species

In my experiments I found the plants of most hybrid species of *T. timopheevi* Zhuk. to be uniform. The head type of the first generation had an intermediate character although for instance the hairiness of the glume, auricle and leaves of the maternal plant as well as the awning of the glumes were equally found on plants of the first generation of the *T. timopheevi* Zhuk. \times *T. carthlicum* Nevski cross, although not so marked as on the parental species (Fig. 1).

According to my examinations the hairiness on the glumes of *T. timopheevi* Zhuk. was somewhat weaker than the hairiness found on other parts of the plants.

I have also studied the form of grain and glume of different hybrid species. When examining from above the caryopsis of the first generation of *T.*



Fig. 1. Intermediate F_1 head type of the *T. timopheevi* Zhuk. \times *T. carthlicum* Nevski cross

timopheevi Zhuk., \times *T. carthlicum* Nevski, I discovered that—irregardless of the years — the grains pointed at both ends were similar to the *T. timopheevi* Zhuk. The pointedness of the base is much more marked. To a certain extent this form of grain is characteristic of the reciprocal crossing of this particular combination and moreover of the *T. timopheevi* Zhuk. \times *T. dicoccum* Schübl. and *T. timopheevi* Zhuk. \times *T. durum* Desf. combinations. The tips of the caryopses of *T. timopheevi* Zhuk. \times *T. aestivum* L. were rather angular. At the same time a considerable percentage of even the F_2 and F_3 generations of *T. timopheevi* Zhuk. \times *T. carthlicum* Nevski, *T. timopheevi* Zhuk. \times *T. dicoccum* Schübl. and *T. durum* Desf. \times *T. timopheevi* Zhuk. combinations was found to have grains with angular tips.

The angle of germs at the F_1 grains of *T. timopheevi* Zhuk. \times *T. carthlicum* Nevski and *T. timopheevi* Zhuk. \times *T. durum* Desf crosses is generally small

(under 45 degrees). On the other hand the angle of germs of the F_1 grains of *T. durum* Desf. \times *T. timopheevi* Zhuk. was larger (between 45 and 55 degrees). The angle of germs of the grains varied in the F_2 and F_3 generations.

I also examined the shape of the glume. The F_1 generation of all *T. carthlicum* Nevski combinations had definite acute glume shoulders and shorter or longer awn stubs (4–12 mm.). The relatively long awns of these hybrids are characteristic of the *T. carthlicum* Nevski species which has very long glume



Fig. 2. Branching and compact head type in the F_2 generation of *T. carthlicum* Nevski \times *T. timopheevi* Zhuk.

awns (averaging 45 mm.) and slightly round glume shoulders. The glume form of the majority of the first generation of *T. timopheevi* Zhuk. \times *T. dicoccum* Schübl. was also similar to *T. timopheevi* Zhuk. There are, however, a small number of awnless glumes almost totally lacking shoulders and resembling the glumes of *T. dicoccum* Schübl. These glumes almost entirely lack teeth and only the small blunt end of the glumes showed the place of the awnlike processes.

In addition to acute shoulders, a great number of glumes have bevelled shoulders, are lance-shaped, possess weakly or strongly curved teeth in the F_2 and F_3 generations of the majority of the above hybrids.

The *T. timopheevi* Zhuk. and *T. aestivum* L. parental species have only slightly noticeable awnlike processes and acute glume shoulders. *T. monococcum* L. has pointed, short teeth and arched acute glume shoulders.

With the exception of the intermediate type individuals appearing, occasionally plants of identical type could hardly be found in the F_2 generation of *T. timopheevi* Zhuk. combinations. Plants similar to the parents were also uncommon. This equally occurred when crossing parental species with identical and different numbers of chromosomes. In addition to their possible practical

significance, these new types and forms may be of importance primarily for evolution. For instance among the 1030 F_2 plants of the *T. timopheevi* Zhuk. \times *T. carthlicum* Nevski crossing I found compact awned glumes, branched heads



Fig. 3. Twin heads found in the F_2 generation of *T. carthlicum* Nevski \times *T. timopheevi* Zhuk.

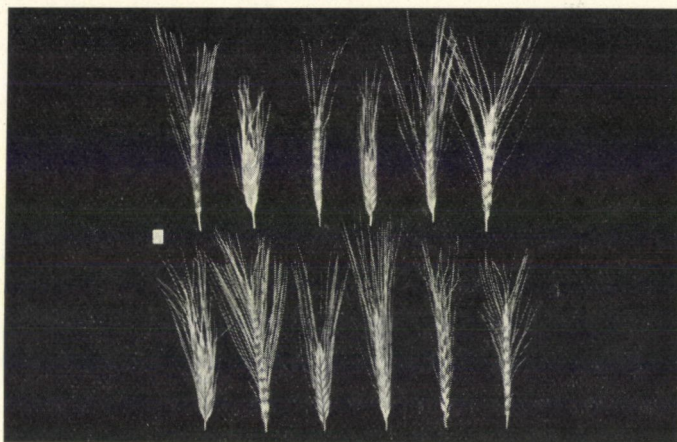


Fig. 4. F_1 and F_2 head types in the *T. timopheevi* Zhuk. \times *T. dicoccum* Schübl. cross (from left to right, 2nd, 5th and 7th speltoid)

(Fig. 2) and twin heads (Fig. 3). New types also occurred in the second generation of *T. durum* Desf. \times *T. timopheevi* Zhuk. and *T. timopheevi* Zhuk \times *T. dicoccum* Schübl. combinations. The latter crossing has resulted in 3.6% of the 182 plants having speltoid heads in spite of the fact that both parents have compact heads (Fig. 4).



Fig. 5. Speltoid, dicoccoid, and compact head types, as well as the one suggestive of *T. durum* v. *leucomelan*, found in the F_3 generation of the *T. carthlicum* Nevski \times *T. timopheevi* Zhuk. cross

Later generations of the above combinations also showed a great diversity of forms. In the F_3 generation of *T. timopheevi* Zhuk. \times *T. carthlicum* Nevski short-awned speltoid, awnless dicoccoid, compact heads were found as well as those resembling the *leucomelan* variety of *T. durum* Desf. (Fig. 5).

Cytological examination

According to observations both in Hungary and abroad not all pollen of the various hybrid species and even of the *Triticum* L. species is viable (Table 1) in spite of normal fertility.

According to my observations pollen sterility was essentially increased in the F_1 generations of the various hybrid species of *T. timopheevi* Zhuk. (Table 2). The pollen of the F_1 hybrids of the *T. timopheevi* Zhuk. \times *T. mono-*

Table 1
Pollen fertility of *Triticum* L. Species
(Two-Year Average)

<i>Triticum</i> L. Species	Number of pollen examined	Average % of fertile pollen	Extremes of fertile pollen %
<i>T. monococcum</i> L.	20	88.4	60.7—98.8
<i>T. dicoccum</i> Schübl.	15	86.4	82.3—92.4
<i>T. timopheevi</i> Zhuk.	34	80.1	69.9—93.2
<i>T. carthlicum</i> Nevski	23	86.2	69.6—94.3
<i>T. aestivum</i> L. (B 1201)	29	77.2	58.6—92.6

Table 2

Pollen fertility of the various F_1 hybrid species of *T. timopheevi* Zhuk.

Combination	Number of plants	Number of pollen	Proportion of fertile pollen %	Extremes of fertile pollen %
<i>T. timopheevi</i> Zhuk. \times <i>T. monococcum</i> L.	9	680	0.6	0.0—1.3
<i>T. timopheevi</i> Zhuk. \times <i>T. carthlicum</i> Nevski	22	9431	5.1	0.0—10.7
<i>T. carthlicum</i> Nevski \times <i>T. timopheevi</i> Zhuk.	8	3013	3.2	0.0—8.9
<i>T. durum</i> Desf. \times <i>T. timopheevi</i> Zhuk.	12	4879	2.9	0.0—4.5
<i>T. timopheevi</i> Zhuk. \times <i>T. dicoccum</i> Schübl.	14	5012	0.8	0.0—1.9
<i>T. timopheevi</i> Zhuk. \times <i>T. aestivum</i> L.	8	3423	1.5	0.0—3.8

coccum L. combinations is almost entirely sterile. The anthers of the plants with a very percentage of pollen sterility (more than 70—80%) did not open, thus those plants unable to self-pollinate were easily recognizable during flowering.

Significant differences brought about by combinations having identical pollen fertility (Table 3) may be found in the F_1 but especially in the F_2 and F_3 hybrid plants. Of the pollen of the types derived from the F_2 generation of the *T. timopheevi* Zhuk. \times *T. carthlicum* Nevski combination 3.5—28.5% was viable, while in the F_3 generation this figure varied between 0.0 and 51.5%. There was an even greater amplitude of variability in pollen fertility among the F_3 hybrids of the *T. durum* Desf. \times *T. timopheevi* Zhuk. combination (7.1—98.7%).

The meiosis of *Triticum* L. species is not perfectly undisturbed either. Aberrations in this species were most frequently shown by the occurrence of chromosome fragments, chromatin bridges and univalence. Rings formed by three chromosomes were also found in a few cases. In 1959 L. BALLA and I discovered that 22.6% of the pollen mother cells of *T. spelta* L. and 21.2% of those of *T. dicoccum* Schübl. had anomalous division (Table 4). The disharmony of reduction-division is essentially greater even in crossings of genetically isolated *T. timopheevi* Zhuk. with tetraploid species than in case of *Triticum* L. species (Table 5). For instance the frequency of unpaired chromosomes in crossings of *T. timopheevi* Zhuk. (AG) \times *T. carthlicum* Nevski (AB) was 78.8%, while in case of crossings of *T. durum* Desf. \times *T. timopheevi* Zhuk. the figure

Table 3

Pollen fertility of the F_2 and F_3 generations of hybrid species of *T. timopheevi* Zhuk.

Combination	Number of plants	Number of pollen	Proportion of fertile pollen %	Extremes of fertile pollen %
F_2 Generation				
<i>T. timopheevi</i> Zhuk. ×	5	895	13.7	3.5—28.5
<i>T. carthlicum</i> Nevski				
<i>T. carthlicum</i> Nevski ×	6	920	12.9	5.3—24.6
<i>T. timopheevi</i> Zhuk.				
<i>T. durum</i> Desf. ×	4	670	15.8	4.1—27.2
<i>T. timopheevi</i> Zhuk.				
<i>T. timopheevi</i> Zhuk. ×	5	716	13.3	0.0—23.9
<i>T. dicoccum</i> Schübl.				
F_3 Generation				
<i>T. timopheevi</i> Zhuk. ×	11	3870	16.0	0.0—51.5
<i>T. carthlicum</i> Nevski				
<i>T. carthlicum</i> Nevski ×	2	370	30.8	27.2—34.4
<i>T. timopheevi</i> Zhuk.				
<i>T. durum</i> Desf. ×	4	596	65.5	7.1—98.7
<i>T. timopheevi</i> Zhuk.				
<i>T. timopheevi</i> Zhuk. ×	3	417	17.1	16.6—17.6
<i>T. dicoccum</i> Schübl.				

Table 4

Irregular meiosis of the *Triticum* L. species (Metaphase I)

<i>Triticum</i> L Species	No. of cells examined	Univalent chromosomes %		Chromatin bridges %		Chrom. frag. %		Chrom. rings %	
<i>T. timopheevi</i> Zhuk.	70	4	5.7	2	2.9	3	4.3	1	1.4
<i>T. carthlicum</i> Nevski	210	1	0.4	3	1.4	2	0.8	—	—
<i>T. durum</i> Desf.	115	1	0.9	—	—	3	2.6	—	—
<i>T. dicoccum</i> Schübl.	70	3	4.1	6	8.6	6	8.5	—	—
<i>T. aestivum</i> L. (B 1204)	80	3	3.7	—	—	2	2.5	—	—
<i>T. spelta</i> L.	85	4	4.9	6	7.0	7	8.3	2	2.4

reached 89.4%. The reduction-division of the above combinations is also evident in the fact that 5% "open" pairing was observed among univalent chromosomes and those conjugating according to "closed" pairing. Naturally a wide

Table 5

Frequency of chromosome configurations in the meiosis of the F_1 hybrids of *T. timophevi* Zhuk.

(Metaphase I)

	<i>T. timoph.</i> × <i>T. carthl.</i>	<i>T. timoph.</i> × <i>T. dicoc.</i>	<i>T. timoph.</i> × <i>T. aest.</i>	<i>T. spelta</i> × <i>T. timoph.</i>
$1_{IV} + 1_{III} + 10_{II} + 8_I$	—	—	2	—
$2_{III} + 9_{II} + 11_I$	—	—	1	3
$2_{III} + 8_{II} + 13_I$	—	—	2	1
$1_{III} + 12_{II} + 8_I$	—	—	7	6
$1_{III} + 10_{II} + 12_I$	—	—	8	6
$1_{III} + 9_{II} + 14_I$	—	—	13	8
$12_{II} + 11_I$	—	—	8	4
$11_{II} + 13_I$	—	—	5	3
$10_{II} + 15_I$	—	—	15	8
$9_{II} + 17_I$	—	—	5	6
$8_{II} + 19_I$	—	—	1	2
$1_{III} + 12_{II} + 1_I$	4	2	—	—
14_{II}	20	9	—	—
$13_{II} + 2_I$	16	14	—	—
$12_{II} + 4_I$	25	37	—	—
$11_{II} + 6_I$	29	23	—	—
Total number of cells	94	85	67	47
Univalent chromosomes	78.8	89.4	100	100

range of intermediate forms may be found alongside the open and closed types of pairing. In the F_1 of the two mentioned combinations I have most frequently found $12_{II} + 4_I$ and $11_{II} + 6_I$ chromosome pairing.

Similar anomalies in the meiosis of *T. timophevi* Zhuk. × *T. dicoccum* Schübl. hybrids were also found.

Euploid forms having proved to be fertile during the growing season occur in fairly great numbers in the F_4 generations of these combinations.

We have found a much more disturbed meiosis in case of *T. timophevi* Zhuk. (AG) × *T. aestivum* L. (ABD) and *T. spelta* L. (ABD) × *T. timophevi* Zhuk. (AG) crosses than in the mentioned combinations where the parents differed not only in genome homology but also in the number of chromosomes. In these combinations less bivalent and proportionally more univalent, trivalent and quadrivalent chromosomes were formed. The $10_{II} + 15_I$ chromosome formation most frequently occurred (Table 5). One cause of this is the partially

homologous character of the G genome of *T. timopheevi* Zhuk. with the B genome of hexaploid wheat. In the hybrids of these crossings trivalence occurred in even greater proportions (e.g., $1_{III} + 9_{II} + 14_I$) and in two cells I even

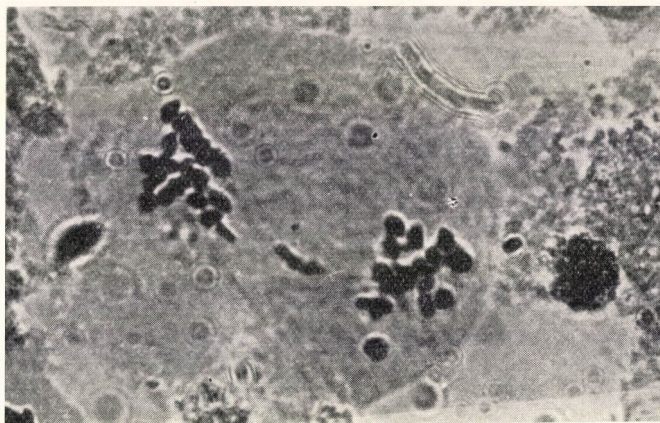


Fig. 6. Chromatin bridge occurring in the F_1 meiosis of the *T. carthlicum* Nevski \times *T. timopheevi* Zhuk. combination

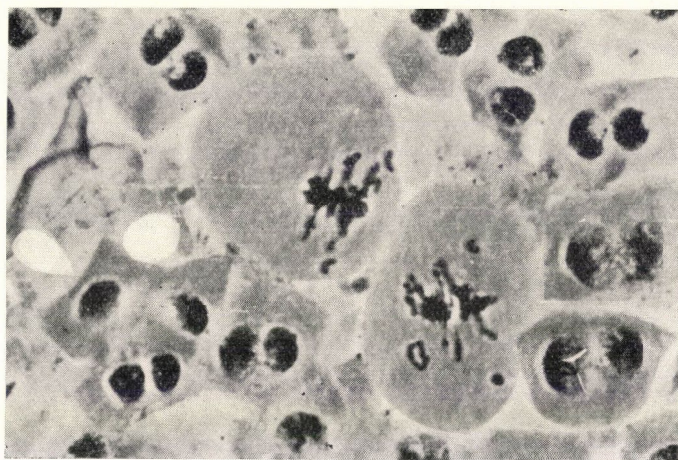


Fig. 7. Formation of a ring of three chromosomes in the meiosis of the F_1 of the *T. timopheevi* Zhuk. \times *T. aestivum* L. combination

found quadrivalence ($1_{IV} + 1_{III} + 10_{II} + 8_I$). Moreover the mentioned anomalies of cell division such as chromatin bridges (Fig. 6), chromosome fragments and rings (Fig. 7) as well as open-type chromosome pairing were more frequent in these combinations.

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ELECTRON MICROSCOPIC STUDY ON THE EXTRACELLULAR CATECHOLAMINE GRANULES IN THE ADRENAL MEDULLA OF THE CHICKEN

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The ultrastructure of the two weeks-old chicken embryo adrenal medulla being subjected to normal- and cold effect, has been studied with special regard to the changes in the glandular cells being beside the sinusoids and in the sinusoids. It has been established that at the time of embryonary development well-defined catecholamine granules are present in the adreno-medullary cells. Occasionally, one-two catecholamine granules were observed in the sinusoids of the normal adreno-medullary cells. Due to cold effect being applied at 0°C for one hour in the sinusoids of the adreno-medullary cells, numerous extrusions of catecholamine containing cytoplasm processes, their separating in the lumen and getting into the system of circulation have been perceived. The phenomenon is considered a special form of induced catecholamine extrusion.

Introduction

As a result of light- and electron microscopic studies on the secretory function of the glandular cells, it is known that in the cytoplasm of the glandular cells the secretory product is generally stored in the form of secretory inclusions (zymogen and other granule). Furthermore, it is also well-known that in the course of the functional activation of the glandular cells the secretory product gets to the spot where it is consumed. In the case of exocrine glands several authors (PALADE 1959; HERMAN et al. 1964) are liable to accept the concept according to which the mature secretory granules reach the lumen of the ductular tube, and being dissolved there, get to the places where they can display their activity.

Much more complicated are the discharging conditions in the case of endocrine glands where in lack of the ductular tube serving for gathering the secreta, the secretion product gets from the glandular cells directly to the blood. Some observations (KUROSUMI 1961) refer to the extrusion of the secretory granules of the thyroid gland and of the adenohypophysis occurring in the same way as the well-known forms of exocrine secretion. On the discharging of the secretory granules of the adrenal medulla, it was DE ROBERTIS (1957) who first published electron microscopic observations. According to his conception the catecholamine containing secretory granules adhere along the cell membrane and discharge their content into the intercellular spaces. From here the secretory product gets into the blood in molecular form

by way of active transport. Besides the above observation DE ROBERTIS gives account also on the moving of intracytoplasmatic catecholamine containing parts within the cell, as well as on the getting out of the cells and getting into the capillars. Recently GORI (1964) and BÄSSLER et al. (1964) have reported on the catecholamine granules surrounded by membrane, being observable in the pericapillar space and also in the lumen of the capillaries.

In the course of electron microscopic studies of chicken adrenal medulla, we found among the medullary cells, first in 1963 and later on in several cases, such kinds of sinusoids in which there were occasionally one or two catecholamine granules. These observations have led us to the assumption that there exists the physiological possibility of catecholamine granules getting into the blood directly. Starting from this notion we have compared the ultrastructure of the adrenal medulla of the normal two weeks-old chicken and of that exposed to cold-effect in order to obtain data at submicroscopic level, on the granule extrusion taking place in the course of hyperfunction.

Materials and Methods

In our experiments we have used two weeks-old chicken embryos. The eggs being taken from the incubator, were kept in refrigerator set at 0° C for one hour. After having broken up the eggs, we made sure which had not perished due to cold-effect, and used only the living individuals for decapitating and electron microscopic purposes, respectively. On the other hand, the individuals being used for control, were employed for electron microscopic preparation right after taking them out from the incubator. After having opened the egg, the embryos were taken off and then being decapitated, the adrenals were cut out carefully. Since the diameters of the adrenals were 0.5–1 mm, part of them were placed immediately in a fixing mixture. The other part of the adrenals were cut into two with a sharp blade and were then placed into the fixing solution. No difference was observed between the blocks being cut out in different ways. In the course of the investigations double fixing was applied. As pre-fixative such 6 per cent glutaraldehyde being buffered to pH 7.6, had been used in which the concentration of the phosphate buffer was 0.15 M and the formaline was present in 4 per cent end-concentration. Fixation occurred at room temperature for 24 hours. Pre-fixation was followed by phosphate buffer washing for 4 hours in the course of which the liquid was changed in every hour. Post-fixation was performed at 0° C in 2% osmium tetroxide for one hour. Osmium tetroxide was buffered according to PALADE (1951). Embedding was performed on the basis of MERCER's (1961) description. The cuttings were made with LKB ultramicrotome. Double contrasting was applied; according to KARNOVSKY's method (1961) post-contrasting was performed following uranylacetate staining for one hour. The pictures were made with JEM 6 C electron microscope.

Results

1. *Fine structure of the adreno-medullary cells and sinusoids of the chicken in normal state*

It is characteristic of the electron microscopic structure at the normal adrenal medulla of the two weeks-old chicken embryo that it is built up of polygonal cells being loosely joined to one another (Fig. 1.). Between the cells wide intercellulars are frequent (ic) in which the cross-sections of the develop-

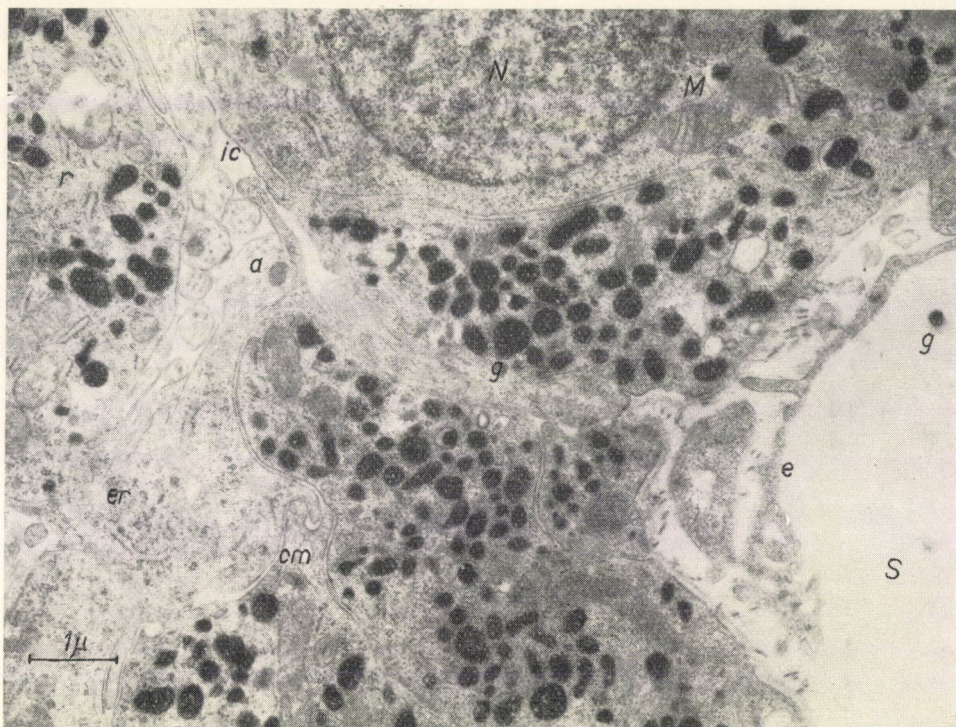


Fig. 1. General electron microscopic picture of the normal adrenal medulla of the two weeks old chicken embryo. In the cells numerous catecholamine granules (g), Palade granules (r) and mitochondria (M) are present. In the sinusoid neighbouring to the cells (S) one catecholamine granule can be observed (g). $\times 20\,000$

ing nerve-fibres (a) and of the connective tissue fibres can be seen. The fine structure of the cells appears in a varied way depending on the phase of their development.

The cell-membrane (cm) corresponding with the form of the cell, is smooth or crinkled to a different extent. On the cell-membrane desmosomes and other cell joining structures can seldom be observed.

The nucleus (N) is of round or of oval shape, its nucleoplasm is poor in chromatine and is uniformly distributed.

The most conspicuous components of the cytoplasm are the highly electron-dense catecholamine granules (g) of different shape and size (500—4000 Å) which are generally surrounded by a well-visible membrane. The catecholamine granules of the embryonal cells are filled up either with a homogeneous and entirely electron-absorbing material, or are of fine microgranular structure. The distribution of catecholamine granules within the cell is generally uniform spreading all over the cytoplasm. In some cases, however, along the

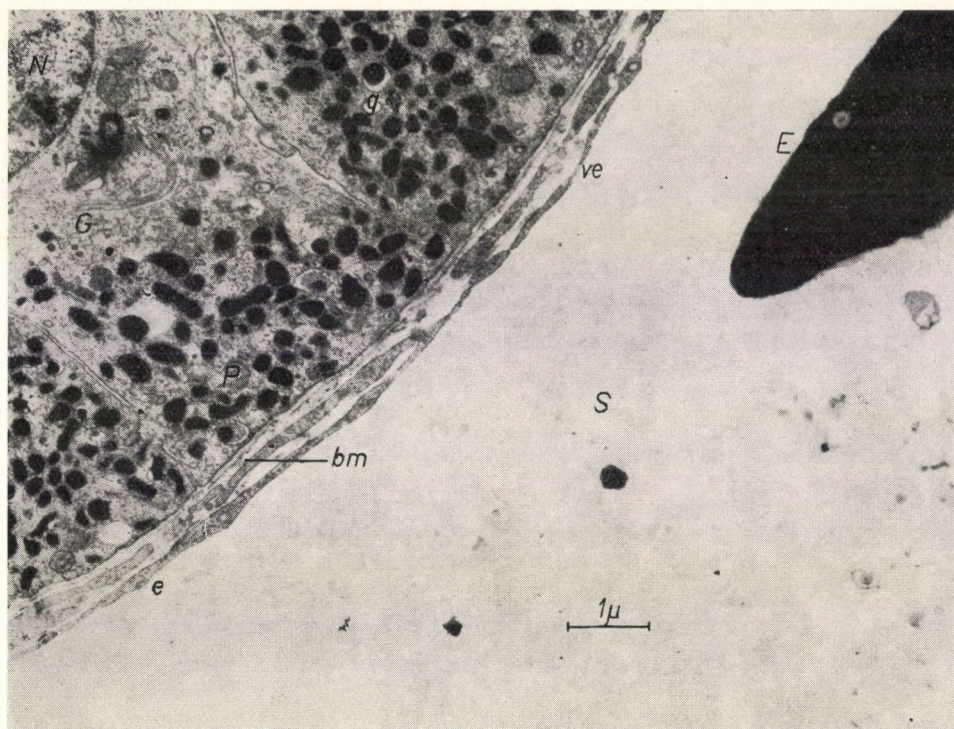


Fig. 2. The granules of normal medullary cells being along the sinusoid (S) are concentrated mainly on the pole of the cells (P). The cytoplasm of the endothel cell (e) is of a well-preserved structure. $\times 20\ 000$

nucleus hardly any catecholamine granule is visible (Fig. 1, N), while on the pole of the cell a definite gathering of them can be observed (Fig. 2, P).

The mitochondria (M) are oval or rod-shaped, containing more or less "cristas".

In the cytoplasm there exist numerous free ribosomes of diffused distribution (r), less lamellar-type endoplasmic reticulum (er). In the surroundings of the ergastoplasm relatively less catecholamine granules take place.

The Golgi apparatus (G, Fig. 2) generally takes place in the neighbourhood of the nucleus and is built up by lamellar as well as by vesicular elements.

Between the groups of glandular cells numerous sinusoids (S) of different size and development and of wide lumen can be found (Fig. 3). In the lumen a few erythrocyte, too, (E) can often be observed. The sinusoids are lined with endothel (e) showing discontinuities of different thickness. In some cases besides glandular cells and the endothel cell, satellite cell, is also present (Fig. 3, Sc). The basal membrane of the sinusoids of the embryonal adrenal medulla is relatively poorly developed (Fig. 2 bm). In the space between the basa

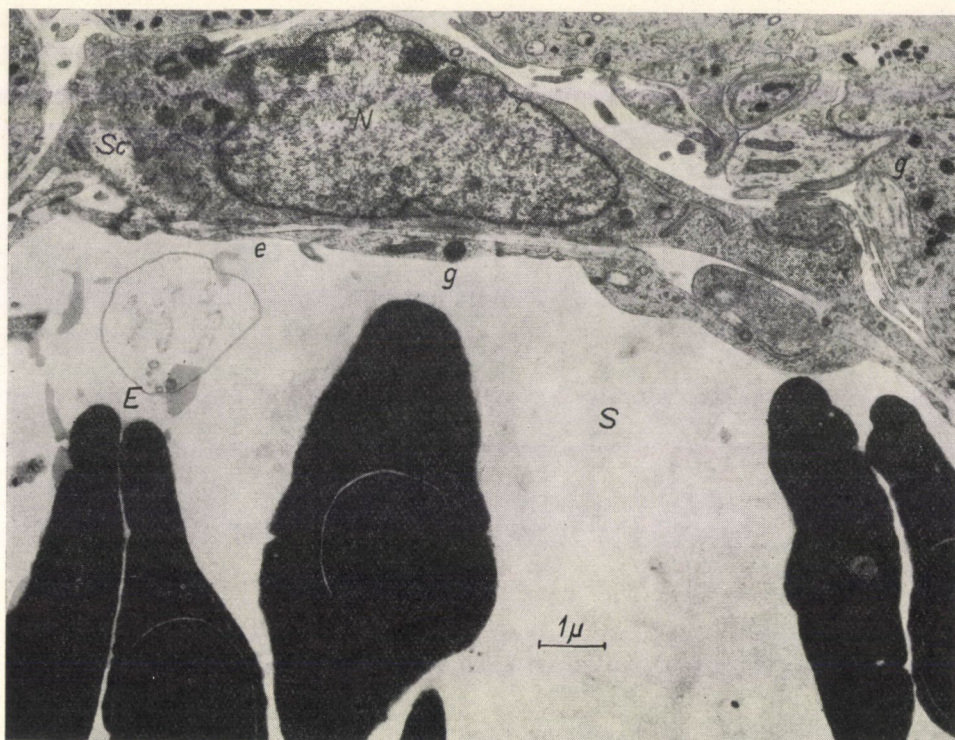


Fig. 3. In the lumen of the adreno-medullary sinusoid of the untreated animals (S) numerous red blood cell (erythrocyte) (E), while between the medullary cells and the endothelial cells a satellite cell (Sc) is visible. In the cytoplasm of the endothelial cell (e) catecholamine granule is present.
 $\times 15\,000$

membrane and the endothelial cell vesicles of varied size and number (Fig. 2 ve) can be observed. In some cases in the lumen of the sinusoids of normofunctional adrenal medulla (Fig. 1 g) or in the cytoplasm of the endothelial cell (Fig. 3) the presence of granules with same size and density as the catecholamine granules, surrounded with membrane or being without it, were observed. The occurrence of these in the sinusoids of the normofunctional adrenal medulla is relatively seldom and their numerical presence is insignificant as compared to the catecholamine granules in the glandular cells.

2. The ultrastructure of the embryonal adreno-medullary cells and sinusoids after cold-effect

As described in the methodical part, some of the incubated eggs had been kept at 0° C in refrigerator for one hour. The most conspicuous ultrastructural alterations are noticeable on the part of the glandular cells that are situated along the lumen of the sinusoids. (In the frame of this paper we do not wish to

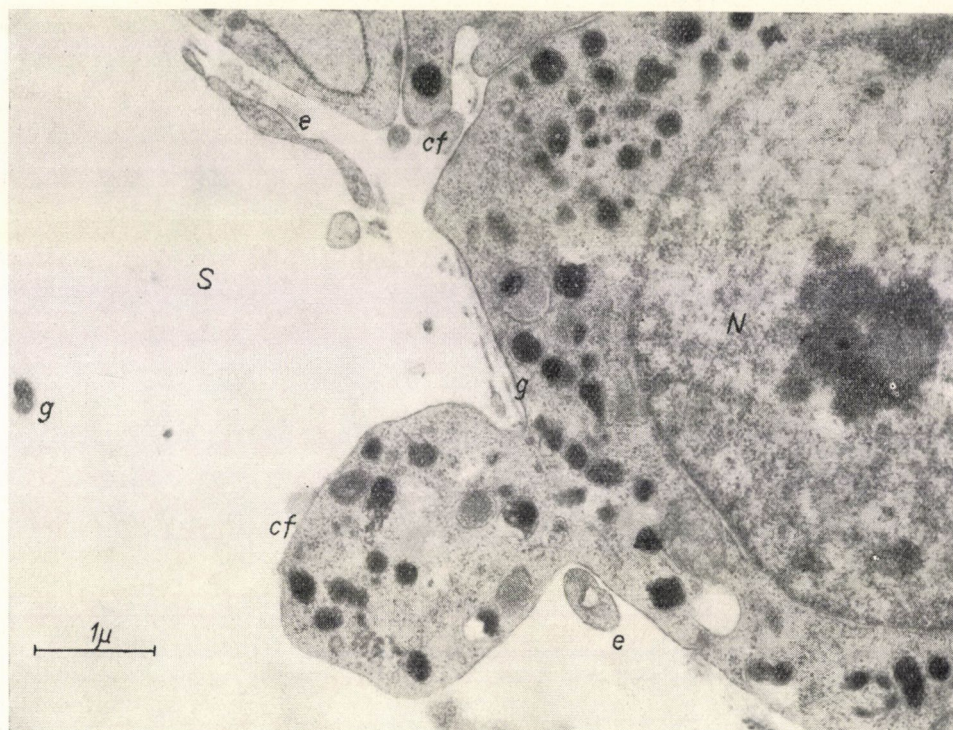


Fig. 4. On the adreno-medullary cell of the chicken exposed to cold-effect cytoplasmic extrusions (cf) can be observed. In these processes more or less catecholamine granules (g) are present. In the sinusoid (S) a singular granule is also present. $\times 28\ 000$

touch upon other alterations.) On the surface of the glandular cells the endothelial cell of the sinusoid is present only in form of short fragments (Fig. 4 e). The most frequent cell alteration shows itself so that from the cell a membrane-bordered cytoplasm particle protrudes into the lumen of the sinusoid. That cytoplasm process is of roundish shape (cf. Fig. 4), the diameter of the basic part is about the half of the longest diameter in the lumen. This fact might refer to the cytoplasm process being in the state of separation from the cell. In the cytoplasm process there can be seen several catecholamine granules. Part of these has well-preserved membranes while others are torn or considerably loosened up. The electron density and size of the catecholamine granules of the cytoplasm process is very varied. In the Fig. 4 another similar cytoplasm-process can be found (cf), in which, however, there is only one granule. In the middle of the lumen a free-standing catecholamine granule can also be observed.

In Fig. 5 the cytoplasm fragments that are in state of separation (cf_1 , cf_2) and those torn off (cf_3) can be simultaneously seen beside one another.

From the cytoplasm of the endothel cell (e) only a small portion is present. On the different cytoplasm-fragments it can be well observed that the bordering membrane of the fragment being on the point of detaching is well-preserved while on the detaching "neck" part it is considerably loosened up. Similarly the bordering membrane of the cytoplasm fragment circulating

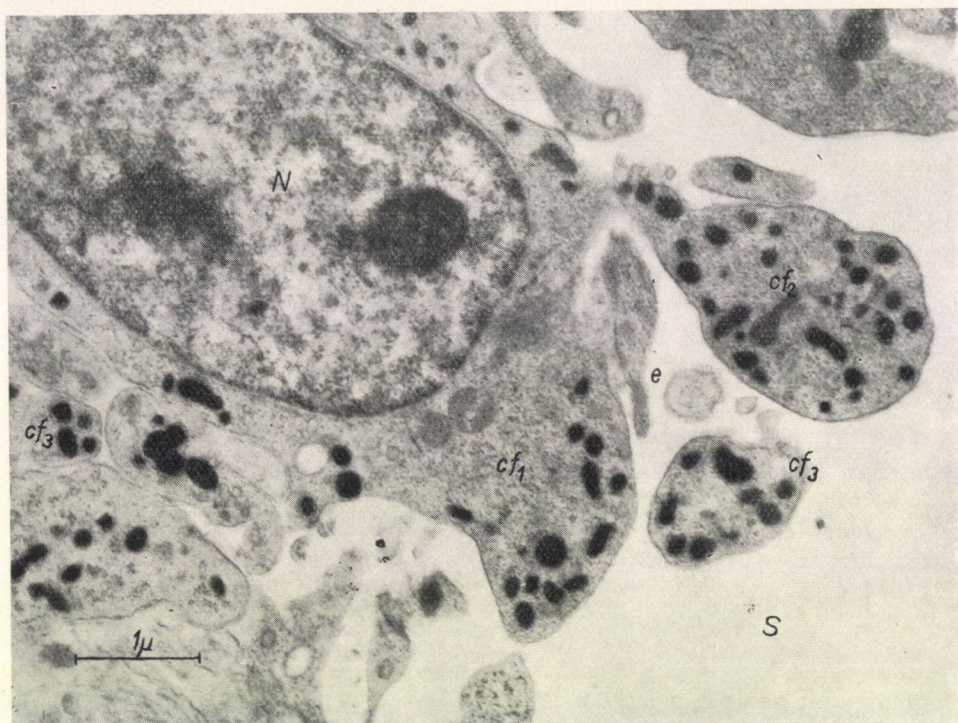


Fig. 5. In this figure the extruding (cf_1), the detaching (cf_2) and the isolated cytoplasmic fragments (cf_3) can be observed at the same time and together, one hour after the cold-effect.
 × 28 000

freely in the lumen (cf_3) is about to be loosened, too. That process is even more evident in Fig. 6 where the untied cytoplasm-portion (cf) got through venous circulation, to the sinusoid being between the cortical-cells (c). The special submicroscopic properties of catecholamine granules (g) can still be established for certain, while the membrane bordering the cytoplasm fragment, is considerably torn. Since in the present case the electron microscopic examining method does not provide an opportunity for quantitative evaluation, it can only be established as a mere tendency that induced cell alterations ensuing under cold-effect, prevail in the glandular cells next the sinusoids in a much higher number and to a much greater extent than in the case of control animals.

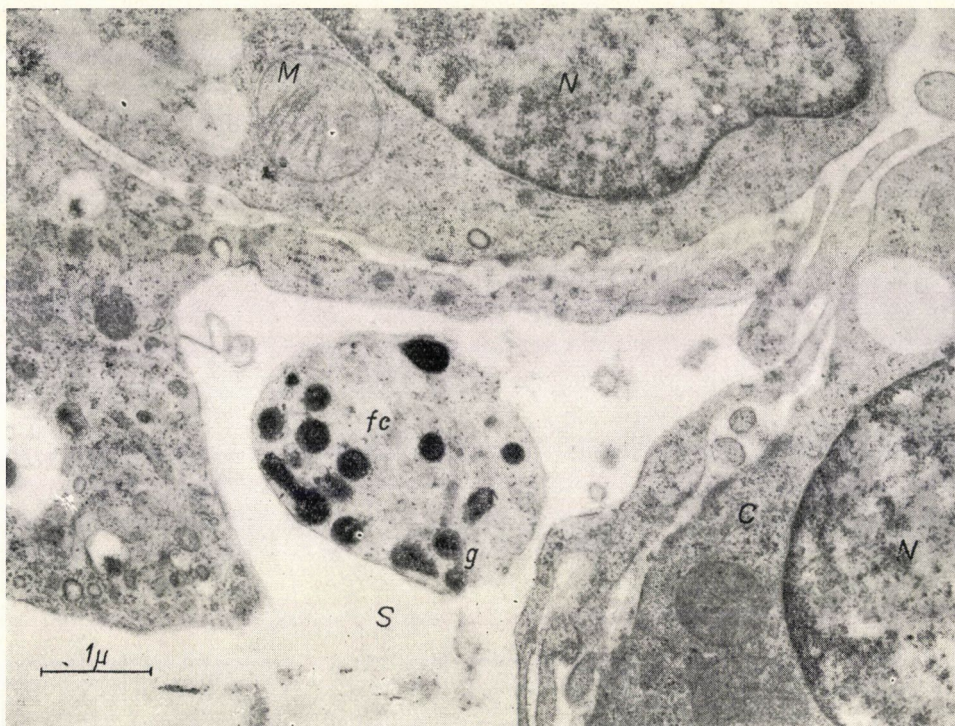


Fig. 6. One hour after cold-effect the cytoplasmic fragment with loosened membrane is visible (cf) in the sinusoid (S) between the cortical cells (C). Part of the catecholamine granules (g) is already in the state of being dissolving, the other part can be identified with certainty on the basis of submicroscopic morphology. $\times 26\ 000$

As a result of cold-effect cytoplasm processes of different size being folded into the sinusoids, their getting off, and the occurrence of detached fragments in the circulatory system, could frequently be observed.

Discussion

The quickly developing electron microscopic histology has rendered possible the analysis of secretory processes at ultrastructural level, altering in hardly one decade our previous concepts on secretion. Especially considerable are the observations referring to the submicroscopic form of appearance, development, storing and discharging mechanism of the secretory material. Electron microscopic examinations have elucidated e.g. that the adrenaline and noradrenaline content of the adrenal is present in the cytoplasm in form of secretory granules and not bound to the mitochondria (WETZSTEIN 1957). Numerous electron microscopic examinations have dealt also with the submicroscopic changes of adrenaline and noradrenaline discharge ensuing under different

loading effects (LEVER 1955; YATES 1964; BENEDECZKY 1965). These investigations have led to the synonymous statement that after different loading influences the catecholamine granules of the adreno-medullary cells diminish partly in number, partly their electron density decreases considerably. One could observe and measure the decrease or disappearance of the secretory material (adrenaline and noradrenaline, respectively) from the substance of the adrenal medulla, one could measure their appearance in blood, the mechanism — on the other hand — through which the hormones got into the blood from the medullary cells, was unknown. The observations of DE ROBERTIS (1957) have outlined even two forms of the discharging of the secretory material. However, the active transport occurring in molecular form has not been proved experimentally up to now, and the gathering of the secretory granules on the cell membrane has been supported so far only by the investigations of KORÉNYI — VIRÁGH (1965) only. Without doubting the discharging possibility of the secretory substance occurring in molecular form, we have to remark that it cannot be taken into account because of its slowness when in the course of a long-lasting loading effect, prolonged discharging of a large quantity of hormone is necessary. Therefore, it seems likely that the organism is capable to secure its rapid catecholamine requirement in some other way, too. For this there might serve as an example the migration of secretory bodies containing intracytoplasmatic catecholamine into blood circulation as described also by DE ROBERTIS (1957). Since the secretory granules have been observed by numerous authors (GORI 1964; BÄSSLER et al. 1964) in the capillary lumen, we are to suppose that the catecholamine granules stored up in medullary cells may be thrust off the cytoplasm at a given stimulus and also under physiological conditions, and getting through the cytoplasm of endothel cells containing wide pores, they may reach the lumen of the capillaries or the sinusoids. Cold-effect as applied in our investigations seemed to be suitable to bring about adrenaline and noradrenaline discharging, respectively, in the adrenal medulla of chicken embryos being very sensitive to the decrease of temperature. The alterations ultrastructurally observed and described have illustrated convincingly that after one hour cold-effect, numerous cytoplasm-fragments containing catecholamine granules, will extrude from the adreno-medullary cells and become separated in the sinusoids thus getting into the circulatory system. Against the observed phenomenon there might arise — as a counterargument — the fact that the embryonal adreno-medullary cells get into the cortex cells by way of cell migration and the above described might, essentially, be brought into relation with intensive cell migration. That hypothesis is contradicted by the fact that in the case of normal embryonal medullary cells, we have never observed cytoplasm-extrusion into the sinusoids; it could be observed only in the case of cold-effect. By way of circulation the cytoplasm fragments separated from the glandular cells, will also get into the vein-lumen

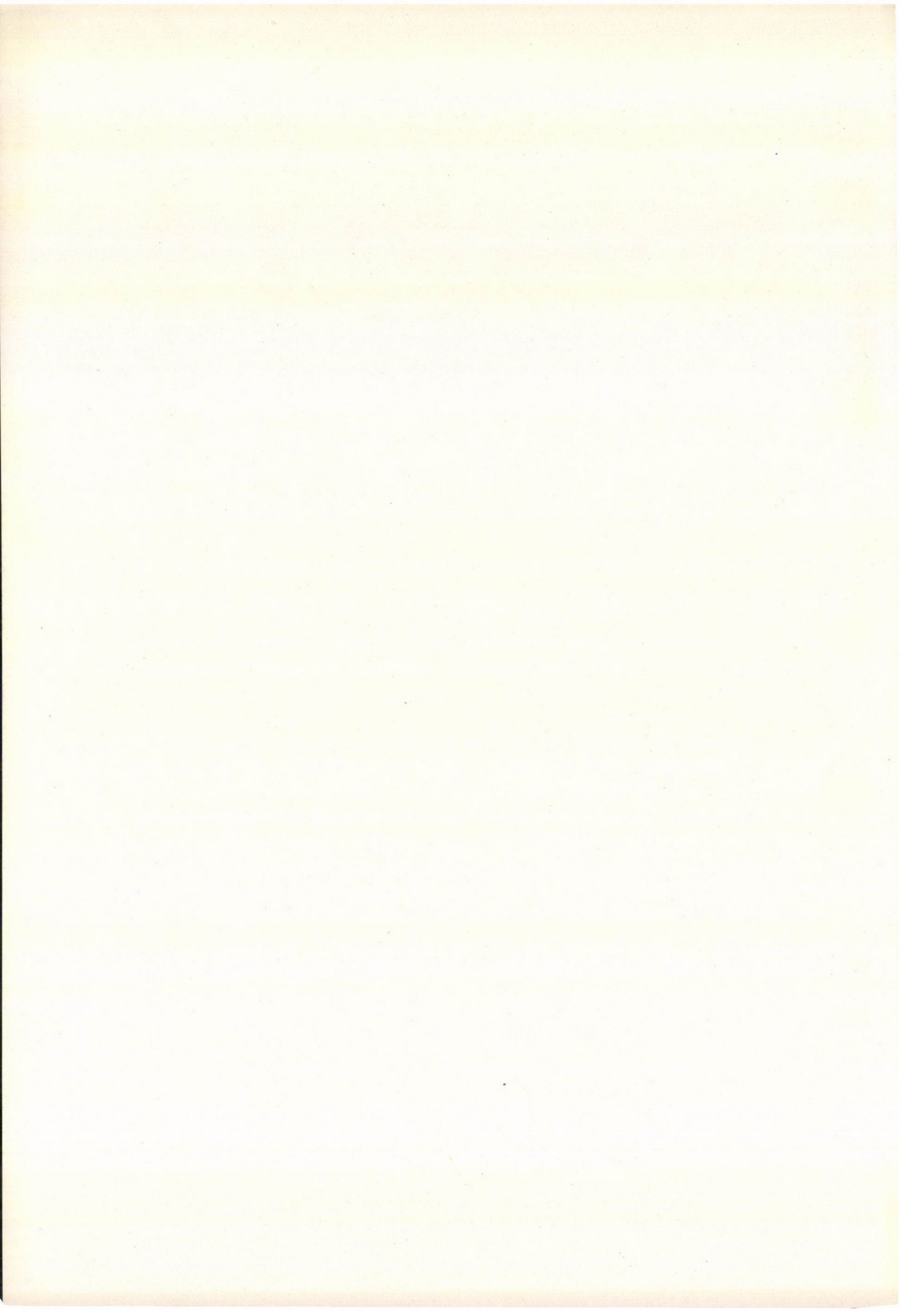
between the cortical cells, as it is seen in our Fig. 6. — However, the cytoplasm fragment has already a very torn membrane here. This refers to the fact that the cytoplasm fragments being in the sinusoids lose soon their morphologic intactness and their content (the catecholamine granules) on getting into blood, can display their effect. On the basis of the above observations it cannot be alleged that in adults the catecholamine discharging is carried through exactly by the same mechanism. It may be possible that only embryonal cells are capable of such plastical cytoplasmic fragmentation. In the adrenal medulla of adult rats we have not experienced the developing of similar cytoplasm processes, while in the sinusoids a large number of catecholamine granules have often been observed (BENEDECZKY 1966). Just for that reason this one experiment cannot submit sufficient basis for judging the general and special discharging ways of the secretory substance; some further investigations are necessary for elucidating the possible hormone discharging forms.

Conclusions

The ultrastructure of normal adrenal medulla of the two weeks-old chicken embryo and that under cold-effect has been studied by way of electron microscope method. It has been established that then the adreno-medullary cells are relatively well-developed containing a large number of mature catecholamine granules, a vast store of ribosomes, mitochondria, lamellar ergastoplasm and Golgi apparatus, too. The sinusoids among the cells are of varied size and development, and are present in relatively large number, their endothel cells containing wide pores. In the lumen of some sinusoids the presence of one-two catecholamine granules has been observed. After the cold-effect applied at 0° C and lasting one hour, we often observed on the glandular cells adjoining the sinusoids developing such catecholamine granules containing cytoplasmic processes that intruded into the lumen of the sinusoids through the gaps of the endothel cells. In some cases the separating of the cytoplasmic-fragments into the sinusoids as well as the occurrence of isolated cytoplasmic-fragments could be easily followed. Since in the case of normal glandular cells no similar alterations have been experienced, it can be supposed that the formation of cytoplasm-fragments containing catecholamine granules and their getting into the circulation system, is the result of the burdening cold-effect, and can be considered a special form of the induced granule extrusion. Since neither in adult chicken adrenal nor in rat a similar phenomenon could not be observed, we suppose that the alterations are related to the character of embryonal cells. The phenomenon is therefore considered a special form of granule extrusion that renders possible rapid and prolonged hormone discharging for eliminating a given damaging effect.

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PIGMENT CHANGES IN ETIOLATED BARLEY LEAVES

By

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Etiolated barley leaves were isolated in water and 10^{-4} mol kinetin solution and illuminated together with intact leaves continuously and for a shorter period. We also worked with purely etiolated plants according to the previous variation. It could be established that kinetin and light had acted together on the pigment components for some time after isolation, after which the signs of decomposition appeared. Pigment decomposition occurring in the dark, viz. general decomposition could not be inhibited by kinetin alone without light even for a short period.

Introduction

Protein decomposition occurring in the detached leaves, reduction of protein content and concurrently the diminution of pigment content are shown by data published earlier. Proteins' splitting off can be observed as soon as a few hours later in the detached leaves where the disintegration of chloroplasts can be measured. In the isolated leaves with the progress of the yellowing process the stroma completely disappears (CHIBNALL 1964). Protein decomposition occurring upon the effect of isolation in barley was investigated by UDVARDY—HORVÁTH (1964). Reduction of the amount of pigments and change of the individual pigment components with the progress of the period of isolation had been published before. The total pigment content in the isolated barley leaf diminishes as compared with the pigment content of the intact leaves both in light and in the darkness. Of the pigment components the amount of chlorophyll-a decreases most explicitly. Total pigment level and amount of chlorophyll-a in the isolated leaves treated with kinetin is above the value of intact leaves (HORVÁTH—LASZTITY 1965, LASZTITY—HORVÁTH 1965).

Our investigations are confirmed by data in literature since several workers have tackled the problem in an other scope of theme (BISHOP—WHITTINGHAM 1963, SIRONVAL et al. 1965, MARSCHNER 1964, LEBEDEV—LITVICHENKO 1965, AUGUSTINUSSEN—MADSEN 1965).

In the present study the problem is examined from a new aspect. Etiolated isolated and intact barley leaves were illuminated continuously and then illumination was applied for a short time, and the pigment change of etiolated plants examined, as well as also the effect of kinetin which had not been investigated yet in such variations.

Material and Method

Experiments were carried out with the MFB barley variety of the Agricultural Research Institute of the Hungarian Academy of Sciences (Martonvásár), under controlled conditions. Experimental conditions and methods were published in our previous studies (HORVÁTH—LASZTITY 1965, LASZTITY—HORVÁTH 1965). In the present work isolated and intact 7 day old etiolated plants were continuously exposed to the effect of illumination with F. 33 light tubes and 8000 lux light intensity. The daily period of illumination was 14 hours. Also 3—6—9 hour illumination was applied with Tungfram incandescent lamp; light intensity was 9000 lux. In all 3 parts of the experiments we isolated also in 10^{-4} mol kinetin solution, beside isolation in tap water. In the application of continuous illumination and with etiolated plants, isolation in tap water and in kinetin solution was conducted so that the leaves were floated in the Petri dish in 2 cm pieces. With the 3—6—9 hour illumination the leaves stood in a beaker. Experiments were carried out with 4 replications.

Experimental Results

The first part of the experiments is presented in Tables 1—2.

It is seen that floated leaf pieces and intact plants were isolated and illuminated for 5 days. The amount of carotene in the leaf pieces floated on the water diminished after a 3 day isolation. In the amount of xanthophylls reduction follows carotene. Both in the amount of chlorophyll-a and chlorophyll-b the reduction takes place after the 3rd day of isolation. Diminution of chlorophyll-a is the most explicit. The amount of carotene and xanthophyll in the leaf portions floated on 10^{-4} mol kinetin solution does not change until the 5th day after isolation. Illumination and kinetin solution together are believed to cause in the amount of chlorophyll-a, an increasing trend until the 4th day after isolation while after the 5th day a substantial reduction occurs. The amount of chlorophyll-b develops similarly to that of chlorophyll-a. Under the influence of 1 day illumination and isolation the values obtained for chlorophyll-a increased so substantially — whereas chlorophyll-b increased too — that this became expressed also by total pigment content.

The amounts of carotene and xanthophyll in the intact leaves showed rather constant values during this period. The amount of chlorophyll-a increased until the 4th day, the time when the intact plant was 11 day old, and the first leaf had already finished its growth, also the second leaf storey was in intensive growth; this is indicated on the 5th day by the reduced value. Chlorophyll-b presents a similar trend as chlorophyll-a. The quantitative change of the two latter components manifests itself also in the amount of total pigments. Isolated and intact ratios illustrate the changes. The second part of the experiments is condensed in Tables 3—4.

After the first and second day of isolation and before the examinations the detached leaves placed in water, into a beaker then in kinetin solution and the rooted control plant were illuminated for 3—6—9 hours. The chlorophyll-a content of the one day old leaves isolated in water increased up till the 9th hour. The value of chlorophyll-b somewhat increased and subsequently di-

Table 1

Quantitative change of the pigment components of isolated and intact 7 day old etiolated barley plant

(Intensity of illumination 8000 lux [F 33] values calculated for γ /mg fresh weight)

Isolation and illumination period in days	carotin	xanthophylls	chlorophyll-a	chlorophyll-b	carotin + xanthophylls	chlorophyll a + b	total pigment
floated on water							
1	0.31	0.46	1.36	0.41	0.77	1.80	2.54
2	0.31	0.40	1.43	0.44	0.74	1.87	2.61
3	0.28	0.395	1.22	0.40	0.68	1.62	2.30
4	0.26	0.36	0.93	0.31	0.62	1.25	1.86
5	0.25	0.34	0.81	0.28	0.59	1.10	1.68
floated on 10^{-4} mol kinetin solution							
1	0.35	0.49	1.34	0.40	0.84	1.74	2.58
2	0.35	0.47	1.49	0.48	0.82	1.95	2.77
3	0.36	0.44	1.60	0.511	0.80	2.10	2.91
4	0.36	0.47	1.79	0.60	0.83	2.38	3.22
5	0.35	0.48	1.59	0.52	0.83	2.11	2.94
intact plant							
1	0.35	0.48	1.37	0.46	0.83	1.84	2.67
2	0.32	0.43	1.55	0.50	0.75	2.05	2.80
3	0.34	0.47	1.69	0.52	0.81	2.21	3.02
4	0.36	0.49	1.79	0.61	0.85	2.40	3.25
5	0.34	0.47	1.59	0.51	0.81	2.10	2.91

minated. The total pigment content which includes all components, gradually increased, and in the 9th hour there was only little difference. On the second day of isolation in water the decomposition of proteins made a progress, which can be observed on the chlorophyll-a values when comparing them with the values of the first day. The chlorophyll-b values exhibit a similar trend. In the 6th hour some effect of light is perhaps observable but it is not prolonged. The latter assumption is also indicated by total pigment content. In the kinetin solution after one day of isolation the illumination by the 9th hour gradually raised the amount of chlorophyll-a. Also the total pigment content showed

Table 2

*Proportion of pigment components of isolated and intact
7 day old etiolated barley plant*

Isolation and illumination period in days	isolated	
	float	intact proportions
	float	float
	on water	on kinetin solution
	intact	intact
1	0.95	0.96
2	0.93	0.98
3	0.76	0.96
4	0.57	0.99
5	0.58	1.01

Table 3

*Pigment changes in isolated and intact etiolated barley
plant under the influence of various illuminations*

(Intensity of illumination 9000 lux, values calculated
for γ /mg fresh weight)

Illumination in hours	Isolated in water					
	1. day			2. day		
	chlorophyll-a	chlorophyll-b	total pigment	chlorophyll-a	chlorophyll-b	total pigment
3	0.61	0.20	1.40	0.54	0.20	1.31
6	0.86	0.29	1.84	0.65	0.21	1.50
9	0.88	0.26	1.82	0.52	0.18	1.28
isolated in 10^{-4} mol kinetin solution						
3	—	—	—	—	—	—
6	0.90	0.37	1.91	0.63	0.30	1.64
9	0.94	0.30	1.97	0.59	0.19	1.51
intact plant						
3	0.44	0.24	1.24	0.58	0.19	1.37
6	0.81	0.26	1.69	0.68	0.23	1.55
9	1.06	0.29	2.08	0.66	0.20	1.52

Table 4
Proportion of the pigment change in isolated and intact etiolated barley plant

Illumination in hours	isolated				intact ratio
	1. day		2. day		
	isolated in water	isolated in kinetin solution	isolated in water	isolated in kinetin solution	
	intact	intact	intact	intact	
3	1.05		1.02		
6	1.09	1.13	0.96	1.65	
9	0.87	0.94	0.84	0.99	

an increase. With the isolation in kinetin solution as regards the effect of light and kinetin together a red uction of about 30 per cent can be observed — until the second day — in the amount of pigments as compared with the 1 day isolation, which seems to verify our assumption according to which on the effect of isolation the protein decomposition or perhaps more correctly a general decomposition takes place in the dark and kinetin alone without light cannot inhibit, even for the shortest time, the decomposition processes.

In the intact plant most outstanding was until the 9th hour the increase of the amount of chlorophyll-a; also chlorophyll-b increased, to a slower rhythm, this is expressed by the increase of total pigment content including all components. All this is readily illustrated by the isolated and intact ratios.

The third part of the experiments was conducted with the 2 cm leaf portions floated on water and kinetin solution and with rooted control plants. The leaves were kept in the dark also after isolation together with the intact plants. Results are compressed in Table 5.

It can be seen from the Table that the carotene content of the etiolated leaf portions floated on water gradually diminished after isolation. After the 4th day occurred an intensive diminution in the amount of xanthophylls. Carotene and xanthophyll content of leaf portions floated in kinetin solution remained approximately on the same level after 4 days of isolation. The values obtained after 5 days of isolation indicate already the diminishing trend; this is the result of the general decomposition which can be readily seen. The intact plants indicate that also in the etiolated plants the growth of the first leaf is finished by the 11th, day. The diminishing trend of the yellow components was explicit as late as on the fifth day of investigation. The isolated and intact ratios in the case of leaf portions floated both on water on kinetin solution illustrate the process described.

Table 5

Changes of the pigment components of isolated and intact 7 day old etiolated barley plant
(Calculated for γ /mg fresh weight)

Isolation period in days	β floated on water			floated on 10^{-4} mol kinetin - β solution		
	carotene	xanthophylls	carotene + xanthophylls	carotene	xanthophylls	carotene + xanthophylls
1	0.29	0.42	0.73	0.28	0.44	0.73
2	0.25	0.39	0.65	0.31	0.46	0.78
4	0.23	0.35	0.58	0.32	0.49	0.81
5	0.18	0.15	0.33	0.28	0.40	0.68

Isolation period in days	intact plant			Isolated	
	carotene	xanthophylls	carotene + xanthophylls	<div> <div> <div>intact ratio</div> <div> <div>floated on water</div> <div>intact</div> </div> <div> <div>floated on kinetin solution</div> <div>intact</div> </div> </div> </div>	
1	0.27	0.41	0.68	1.07	1.07
2	0.29	0.39	0.68	0.95	1.13
4	0.26	0.36	0.62	0.93	1.30
5	0.23	0.30	0.53	0.62	1.29

Conclusions

It can be established that the amount of chlorophyll-a accumulating in the floated etiolated isolated leaves under the influence of illumination diminishes from the 3rd, day after isolation, and so does the amount of the yellow pigment components. In the variant floated on the 10^{-4} mol kinetin solution the amount of chlorophyll-a increased until the 4th, day of isolation; then followed the decomposition retained for some time by kinetin then accelerated by isolation. The pigment components of the intact etiolated leaves showed increasing values until the end of as long as the growth of the leaf, was finished. Such statements can be also found in literature (MARSCHNER 1964, AUGUSTINUSSEN—MADSEN 1965).

Under the influence of short term illumination after 1 day of isolation the pigment content increased also in the leaves isolated in water, until the 9th hour. It is the amount of chlorophyll-a that was significant. With the isolation in kinetin solution the previous statement is after 1 day still more explicit — for the amount of pigment components. After two days of isolation a reduction ensued in pigment content both with isolation in water and in kinetin solution. This seems to verify our assumption that kinetin in itself without light cannot inhibit the protein-pigment decomposition arising under the influence of isolation in the dark. In the intact control plant it was in the amount of chlorophyll-a that took place accumulation until the 9th. hour.

Etiolated plants kept in the dark and isolated in kinetin solution retained the amount of yellow components until the 4th day; then diminished the values with the isolation in water the reduction of the yellow components was gradual from the first day of isolation. This statement is also in agreement with the communication of CHIBNALL—WILTSHIRE (1954).

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CHANGE OF THE HULL CONTENTS OF WHEAT ACCORDING TO VARIETY AND ENVIRONMENT

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In the quality testing flour laboratory of the Martonvásár Agricultural Research Institute of the Hungarian Academy of Sciences, examinations were carried out in the years 1962 and 1964 in various experiments on the differences in hull content among winter wheat varieties and likewise on the effect of the environmental conditions on hull content.

According to the data obtained there are considerable differences between the inherited hull content of the varieties which under proper conditions also assert themselves.

Under the influence of increasing dosage rates of fertilizer the hull content of wheat increased. Full fertilizer application increased the hull content to the highest degree.

From the experiments established at ten different sites of the country in the experimental places of the Great Hungarian Plain (*Alföld*) on chernosem soils and under influence of less precipitation, yields of better quality but at the same time of higher hull content have developed.

On the basis of the data of several experiments it can be stated that the hull content of the variety *Besostaya* is very favourable because it is the lowest both according to varieties and to treatments.

Introduction

One of the most important indices of the milling quality of wheat is the value of flour output. The thinner the hull of a wheat variety, the more favourable is the flour output, since thicker hull is accompanied by a relative reduction of the endosperm and signifies lower amount of flour. Therefore, with a view to national economy wheat varieties of low hull content are of high significance. When the higher yield of a wheat variety is due to higher hull content this is not advantageous from the viewpoint of industry.

The hull content is a hereditary property characteristic of the variety which is considerably influenced by the environment. Its ultimate development depends on both factors. Therefore already the breeder has to take into consideration this distinctive feature in the course of selection. At the same time also the grower must be aware of the environmental influence on the hull content of wheat. Nevertheless, comparatively little has been known as yet on the relationship between hull content and environment and regular hull examination is not widespread in the breeding work either. This deficiency is

due, in our opinion, to the difficulties connected with the methods of examination.

A number of workers have dealt with the significance of the hull content of wheat. Both systematical and experimental data can be found in abundance in the works of NOSATOVSKY (1951), KOZMINA—KRETOVICS (1952), LELLEY—RAJHÁTHY (1955), MRS. B. MAJOR (1960) and others. On the authority of data the hull content of wheat is very different in various countries. According to a communication of KOSUTÁNY (1907) e.g. the average hull content of 40 wheat varieties was 15.06 per cent in France. ROEMER—PELSHENKE (1932) established a hull content of 10–14 per cent in German wheat varieties. NEUMANN—PELSHENKE (1954) have drawn the attention to the fact that there are great differences between the hull content of winter and summer wheats. The average hull content of the German summer wheats was 14.1 per cent as compared with 12.3 per cent in the winter wheats. In the experiments of LELLEY (1958) the hull content of 10 Hungarian winter wheat varieties ranged from 8.96 to 10.86 per cent. According to the statement of KOZMINA—KRETOVICS (1952) the hull content of the varieties Melanopus 69 and Ukrainka was 8.87 and 8.55 per cent in the Ukraine, thus substantially lower than in the western wheats. On the strength of these data the oceanic climatic conditions generally resulted in higher, the continental conditions in lower hull contents.

Also the determination of the ash content of wheat gives a comparatively good information on the hull content of wheat. FOERSTER (1960) beside the ash content of various wheat varieties examined also their protein content and found in his experiments no connection between the total ash content of the grain and the amount of protein. In the experiments of ROEMER—PELSHENKE (1932) there was no relationship either between the hull content of various wheat varieties, the thousand grain weight and the hectolitre weight.

To-day many methods are available already for the determination of the hull content of wheat. Evaluation of data found in literature is not infrequently difficult owing to divergences in methods. In our quality testing laboratory the methods described in the papers of LELLEY (1958), LAZÁNYI (1961) and IBRÁNYI (1963) had been compared. As to the varietal order nearly identical results were obtained with all three methods. Detailed examinations were carried out with the quick method of IBRÁNYI because this seemed to be best suited for the testing of the huge material. In our further experiments partly the varietal differences of hull content and partly the influence of the environmental factors on hull content were investigated.

Material and Method

The hull content of wheat was investigated on the experimental material of KOLTAY (1963–1964) at Martonvásár in the experiments of the National Institute for the Qualification of Agricultural Varieties and Production Techniques established in 10 stations and on experi-

ment material of MESCH in Tápiószele. Hull content was calculated for the dry matter of wheat and all experimental data represent the mean of 4 replications.

Yields of the following experiments were examined:

I. The experiment of KOLTAY (1963) established in Martonvásár on the field U $1\frac{1}{7}$ with 3 varieties included the following treatments:

1. \emptyset
2. 100 q/cad. hold* farmyard manure
3. 200 q/cad. hold farmyard manure
4. NPK₁ (250 kg) cad. hold *Pétisó****, 150 kg/cad. hold superphosphate and 150 kg/cad. hold 40% potassium salt)
5. 100 q/cad. hold farmyard manure + NPK₁
6. 200 q/cad. hold farmyard manure + NPK₁
7. NPK₂ (500 kg/cad. hold *Pétisó*, 300 kg/cad. hold superphosphate and 300 kg/cad. hold 40% potassium salt)
8. 100 q/cad. hold farmyard manure + NPK₂
9. 200 q/cad. hold farmyard manure + NPK₂

In the experiment of randomized block layout with four replications farmyard manure, phosphorus and potassium were incorporated in the soil before seeding. As to the nitrogen fertilizer one third was given before seeding as ground fertilizer and two thirds on April 8 as top dressing.

II. In the experiment of KOLTAY (1964) in Martonvásár on the fields U $1\frac{1}{7}$ and Tsz of 5×5 Latin square layout the variety *Fertődi 293* obtained the following head dressing doses in the spring:

* 1 cad. hold = cadastral hold = 0.57 ha

** calcium carbonate-ammonium nitrate fertilizer manufactured in Hungary

1. \emptyset
2. 80 kg/cad. hold N-active agent
3. 80 kg/cad. hold P_2O_5 active agent
4. 80 kg/cad. hold N + 80 kg/cad. hold P_2O_5
5. 80 kg/cad. hold N + 80 kg/cad. hold P_2O_5 + 80 kg/cad. hold K_2O .

In this experiment beside the hull content of wheat other quality tests (ZELENY-number, laborograph, aleuron quantity, aleuron-expansivity, thousand grain weight) were conducted.

III. From the experiment on "winter wheat varieties" of the National Institute for the Qualification of Agricultural Varieties and Production Techniques hull content of the *Besostaya 1* and *Fertődi 293* varieties originating from 10 different places was examined. The varieties received in all experiments the same amounts of fertilizer. From the chemical fertilizer containing a total of 100 kg/cad. hold pure active agent 35 kg/cad. hold P_2O_5 and 10 kg/cad. hold K_2O doses were applied as ground fertilizer before seeding. From the 55 kg/cad. hold nitrogen one third was given in the autumn as ground fertilizer and two thirds in the spring as top dressing. In this experiment, beside the hull content the above listed quality tests were performed as well.

IV. From the winter wheat varietal collection of MESCH broadcast in Tápiószele, the hull content of 25 varieties was determined in 1962 and 1964.

V. out of the machine-seeding experiment with five replications of MESCH in 1964 the hull content of 25 varieties was examined and the pharinographic scores and thousand grain weight determined.

Experimental Results

I. In the 1963 experiment the hull content of the varieties *Besostaya 1* (Fig. 1), *Fertődi 293* (Fig. 2) and *Skorospelka* (Fig. 3), as calculated per dry matter, increased upon the influence of growing fertilizer doses. The rate of increase, however, was not uniform. In the varieties *Besostaya* and *Fertődi 293* the highest hull content was obtained in the 8th treatment. For these varieties

the highest rate of increase was + 2.81 and 3.29 absolute per cent. The hull content of the variety *Skorospelka* increased to the highest degree with treatment No. 9 (+ 3.96 per cent). From the viewpoint of hull content at the

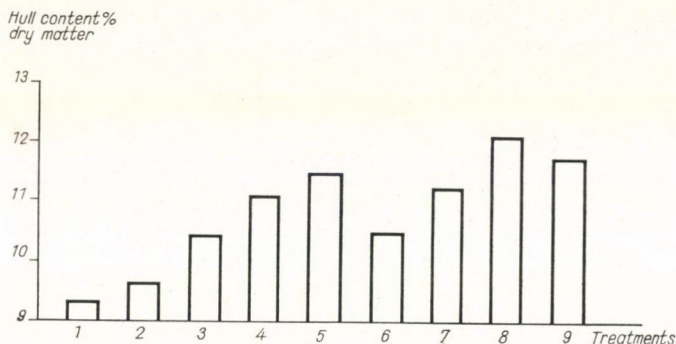


Fig. 1. Fluctuation of hull content according to fertilizer treatments in the variety *Besostaya* 1. Martonvásár, 1963

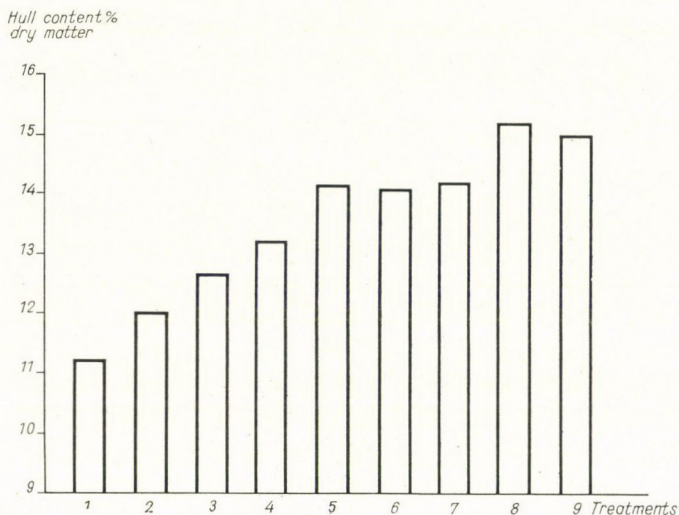


Fig. 2. Fluctuation of hull content according to fertilizer treatments in the variety *Fertődi 293*. Martonvásár, 1963

varieties examined *Besostaya* was the most valuable because it had, in the case of the untreated control, the lowest hull content (9.31 per cent) and the increase of hull content upon the effect of fertilizer application was the lowest as well. The most disadvantageous is the variety *Fertődi 293* because here the corresponding values are the highest. It is remarkable that this variety has responded to all fertilizer treatments with a high increase of hull content. The increase of hull content for the variety *Skorospelka* was of a very small

scale except for treatment No. 9. From the data it could be established that the varietal differences in hull content when comparing the untreated controls were substantially smaller than the differences which arose upon the influence of fertilizer application.

II. In the 1964 experiment hull content and scores of quality testing were expressed in per cent of the untreated control.

On the field U 1/7 (Table 1) nitrogen and phosphorus fertilizer increased the hull content also in themselves separately but the greatest increase was

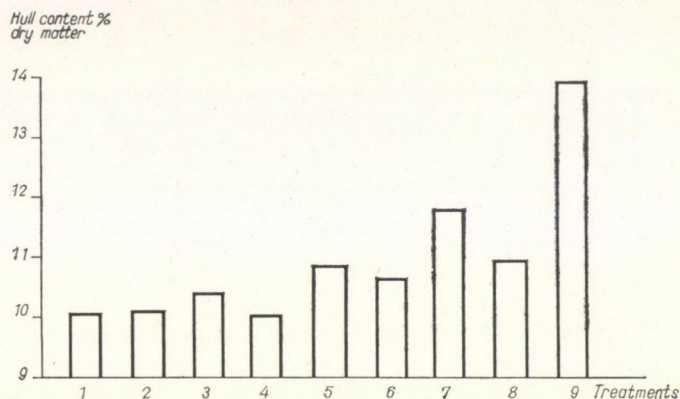


Fig. 3. Fluctuation of hull content according to fertilizer treatments in the variety *Skorospelka*, Martonvásár, 1963

caused by the three fertilizers together. Similarly changed upon the influence of the chemical fertilizers the ZELÉNY number, the laborographic score and wet aleuron. Nitrogen dosed out in itself (treatment No. 2), however, forms an exception, since on its influence the quality scores increased to a higher extent than the hull content. In this experiment the effect of chemical fertilizers on the expansivity of aleuron is remarkable. In the treatment No.2. the 10.5 per cent increase of aleuron expansivity upon the influence of N given alone means a deterioration of quality as against the increase of the ZELÉNY number, the laborographic score and the value of wet aleuron. As an effect of phosphorus (treatment No.3) and full fertilizer application (treatment No.5) the expansivity of aleuron gradually decreased. Since other qualitative scores simultaneously increased, full fertilization proved to be of double favourable effect. Hull content forms an exception as it has increased to the highest degree upon the influence of full fertilizer application. No relationship was found between thousand grain weight and hull content in this experiment.

Similar conclusions can be drawn from the data of the experiment established on the field Tsz (Table 2). Numerical divergences of experimental values are due to the differences of the soil type from the soil of previous ex-

Table 1

Scores of the winter wheat *Fertődi 293* (field U 1/7)
Martonvásár, 1964

Treatments	Hull %	Zeleny Nr.	Laboro- graph corr. area	Wet aleurone %	Aleuron expan- sivity mm	Thous- and grain g
	in per cent of the untreated control					
1. Untreated	100.0	100.0	100.0	100.0	100.0	100.0
2. 80 kg/cad. hold N active agent	102.9	123.2	115.0	120.1	110.5	96.6
3. 80 kg/cad. hold P_2O_5 active agent	102.1	101.1	97.5	101.6	105.9	99.0
4. 80 kg/cad. hold N + 80 kg P_2O_5	104.6	125.6	112.9	118.1	106.5	98.5
5. 80 kg/cad. hold N + 80 kg P_2O_5 + 80 kg K_2O	106.5	133.5	127.2	117.1	101.9	100.9

Table 2

Scores of the winter wheat *Fertődi 293* (field Tsz.)
Martonvásár, 1964

Treatments	Hull %	Zeleny Nr.	Laboro- graph corr.	Wet aleurone %	Aleuron expan- sivity mm	Thous- and- grain weight g
	in per cent of the untreated control					
1. Untreated	100.0	100.0	100.0	100.0	100.0	100.0
2. 80 kg/cad. hold N active agent	105.1	115.3	125.5	118.9	150.0	94.4
3. 80 kg/cad. hold P_2O_5 active agent	98.5	100.0	117.1	101.2	94.6	103.2
4. 80 kg/cad. hold N + 80 kg P_2O_5	105.7	115.3	133.5	112.1	94.6	103.1
5. 80 kg/cad. hold N + 80 kg P_2O_5 + 80 kg K_2O	112.9	105.6	132.5	110.0	85.9	106.1

periment. Hull content on the effect of pure nitrogen and full fertilizer application has highly increased, by almost double of the value found in the previous experiment. The data seem to evidence that the soil type has at least the same influence on the development of hull content as fertilizer application.

III. The soils of the experiments launched at ten different places of the country in 1964 have been characterized on the basis of the genetic soil-map of STEFANOVICS—SZÜCS (1961) (Table 3). Data characteristic of the precipitation conditions of the experimental stations are presented in Table 4 on the basis of the data of the National Meteorological Institute.

Hull content of the variety *Besostaya* (Fig. 4) is, in agreement with the previous experiments, both on the average and for each station lower than in the variety *Fertődi 293* (Fig. 5.). Hull content in the variety *Besostaya* has

Table 3
Soil types of experimental stations 1965

Stations	Genetic soil types
1. Eszterág	Forest soil "brun lessivé"
2. Mosonmagyaróvár	Meadow clay calcareous silt developed on alluvial sediment
3. Táplánszentkereszt	Medium heavy loam developed on Raman's brown forest soil
4. Kompolt	Heavy clayey loam developed on meadow soil
5. Tordas	Clayey loam developed on typical chernosem with lime deposit
6. Kopáncs	Medium heavy loam on meadow solonetz soil
7. Iregszemcse	Medium heavy loam developed on brown chernosem forest soil
8. Székkutas	Medium heavy loam developed on chernosem of the Alföld with lime deposit, salinized in the depth
9. Karcag	Clayey loam developed on meadow solonetz soil, loess sediments
10. Nagykálló	Chernosem of the Alföld with lime deposits developed on loess ridge

Table 4
Precipitation during the vegetation period in mm
Ten stations, 1963-64

Stations	1963			1964						Total precipitation during vegetation period
	Oct	Nov.	Dec.	Jan.	Feb.	March	April	May	June	
1. Eszterág	24	45	81	4	24	57	70	55	138	498
2. Mosonmagyaróvár	29	49	17	1	13	46	78	65	56	354
3. Táplánszentkereszt	30	51	29	0.2	19	72	73	63	70	407.2
4. Kompolt	43	5	33	4	17	42	17	36	97	294
5. Tordas	19	20	49	3	33	38	26	27	147	362
6. Kopáncs	17	35	90	4	15	57	57	27	77	379
7. Iregszemcse	27	35	57	3	20	50	41	63	103	399
8. Székkutas	25	26	72	4	13	42	43	37	71	333
9. Karcag	30	11	54	3	13	51	34	55	99	350
10. Nagykálló	50	13	27	3	23	68	51	57	50	342

increased as against the lowest hull content (9.11) by maximum 2.36 per cent, in *Fertődi* 293 by 4.66 absolute per cent as compared with the lowest value (9.21). The hereditary lower hull content of the variety *Besostaya* was evidenced also on the ten growing stations.

Both in the case of *Besostaya* (Table 5) and *Fertődi* 293 (Table 6) on the experimental stations of the Great Hungarian Plain (Alföld) and in Iregszemcse the scores of quality testing are higher than the average. At the same time less precipitation fell in these places during the vegetation period as compared

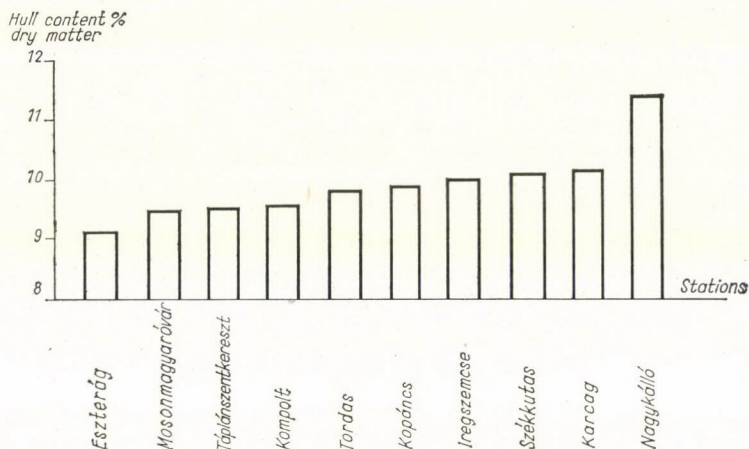


Fig. 4. Fluctuation of hull content according to stations in the variety *Besostaya I.* 10 stations 1964

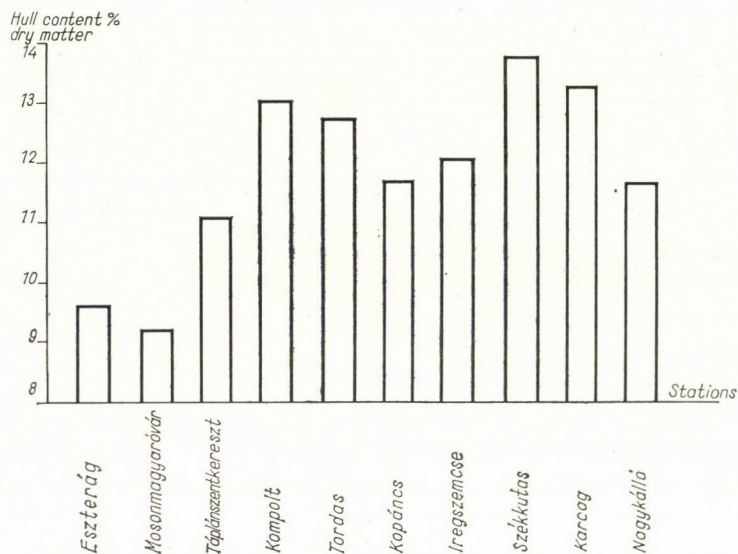


Fig. 5. Fluctuation of hull content according to stations in the variety *Fertődi 293.* 10 stations 1964

with the other growing stations, especially those of Transdanubia. It is also remarkable that in the stations which received significantly more precipitation the hull contents and also the qualitative scores are lower. The relationship between oceanic climate and higher hull content stressed in literature has not manifested itself in the experiment and even an opposite trend has been found. This points to the fact that the relationship asserting itself on large climatic areas cannot be applied in all cases to smaller areas and on the other hand that

Table 5
Qualitative scores of winter wheat Besostaya 1
 Ten stations, 1964

Stations	Hull %	Zeleny Nr.	Laborograph corr. area	Wet aleurone %	Thousand grain weight g
	Percentual values related to the mean of 10 stations				
1. Eszterág	91.7	96.3	61.5	97.9	102.1
2. Magyaróvár	95.4	89.7	68.7	79.8	116.1
3. Táplánszentkereszt	95.5	102.5	94.6	98.1	99.3
4. Kompolt	96.3	112.0	109.8	102.3	98.8
5. Tordas	99.0	93.0	51.7	99.9	96.4
6. Kopáncs	99.4	73.8	89.0	93.1	95.8
7. Iregszemcse	100.2	112.0	124.8	93.1	100.8
8. Székkutas	102.0	102.2	163.5	116.1	93.9
9. Karcag	102.2	112.0	130.1	111.4	92.9
10. Nagykálló	115.0	105.8	121.9	112.6	103.0
Average in absolute value	9.94	31.2	34.3	37.6	36.70

Table 6
Qualitative scores of the winter wheat Fertődi 293
 Ten stations, 1964

Stations	Hull %	Zeleny Nr.	Laborograph corr. area	Wet aleurone %	Thousand grain weight g
	Percentual values related to the mean of stations				
1. Eszterág	81.4	66.9	32.3	74.9	106.1
2. Mosonmagyaróvár	77.8	87.2	63.5	80.6	105.1
3. Táplánszentkereszt	94.0	98.9	83.9	94.0	98.4
4. Kompolt	110.5	122.0	128.8	110.0	104.2
5. Tordas	107.2	101.9	71.4	99.5	104.0
6. Kopáncs	99.4	90.3	94.0	102.9	97.6
7. Iregszemcse	102.4	98.9	112.0	89.5	96.5
8. Székkutas	106.7	101.7	134.5	115.5	88.9
9. Karcag	112.0	116.3	153.0	120.0	95.3
10. Nagykálló	99.4	116.3	129.2	112.9	104.3
Average in absolute value	11.8	34.4	36.6	42.5	32.44

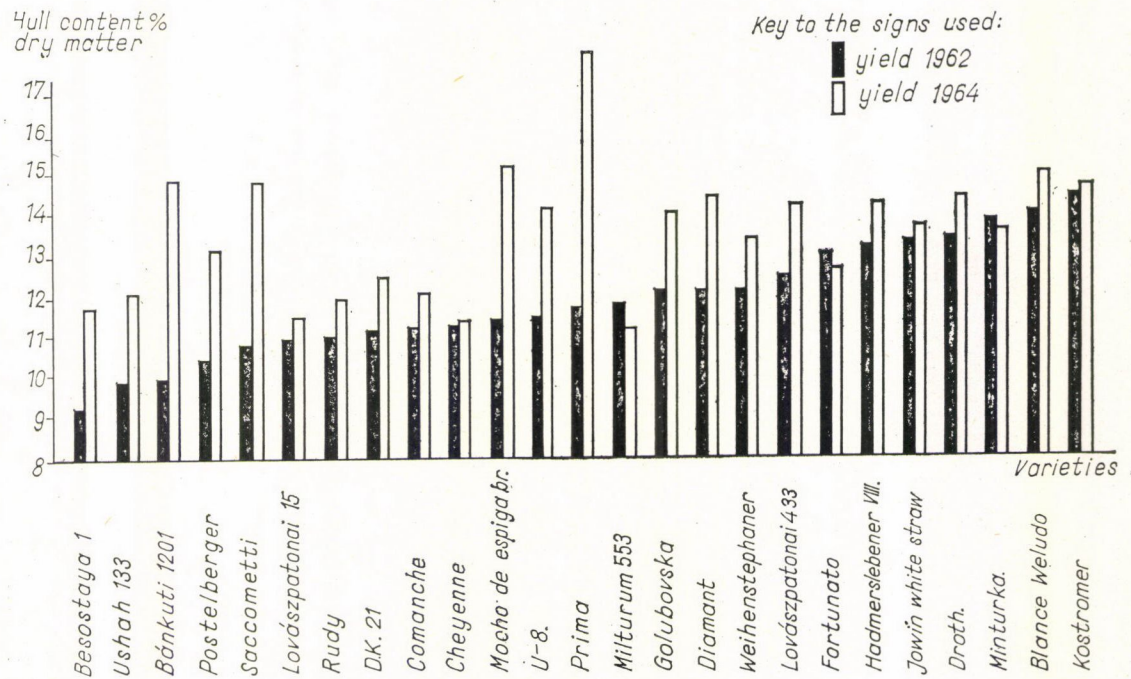


Fig. 6. Annual fluctuation of hull content Tápiószele, 1962—1964

Table 7

Hull content and qualitative data of winter wheat varieties
Tápiószele, 1964

Varieties	Hull % dry matter	Farinographic score	1000 grain weight
1. <i>Besostaya 1</i>	8.98	83.7	41.5
2. <i>Karcagi 388</i>	9.43	60.4	31.8
3. <i>Skorospelka 3/b</i>	10.28	57.9	36.0
4. <i>Kozlovec 3</i>	10.51	53.3	29.3
5. <i>Bánkúti 1201</i>	10.56	67.2	37.0
6. <i>Belocerkovskaya 198</i>	10.63	85.3	39.0
7. <i>Autonomia</i>	10.83	67.8	37.9
8. <i>San Pastore</i>	10.89	31.2	36.7
9. <i>Branitzka Kolkunov</i>	10.97	53.3	34.5
10. <i>Mironovskaya 808</i>	10.98	85.9	38.9
11. <i>Pawnee</i>	11.00	56.6	33.1
12. <i>Cimarron</i>	11.02	58.3	34.5
13. <i>Ottawa</i>	11.03	71.6	30.2
14. <i>Jubilejna III.</i>	11.06	29.7	31.8
15. <i>Kecskeméti 175—198</i>	11.16	63.5	32.6
16. <i>Record</i>	11.32	83.7	37.5
17. <i>Etoile de Choisy</i>	11.37	36.6	36.5
18. <i>Knox</i>	11.37	59.6	34.1
19. <i>Prof. Hermann Sadovo</i>	11.56	65.4	—
20. <i>U8/47</i>	11.60	77.1	30.1
21. <i>Garant</i>	11.64	80.0	38.0
22. <i>Z. Imperial</i>	11.75	71.3	37.0
23. <i>Fertődi 33</i>	11.80	65.7	39.0
24. <i>Cenad 512</i>	12.06	70.5	40.7
25. <i>U 8/85</i>	12.26	84.2	42.5

this relationship is influenced beside climatic factors by soil and other factors. The experimental soil of the four last stations is mainly chernosem which is known to be highly suitable for wheat production and particularly for high quality wheat production. It is also well known that alkali (*Szik*) soils favour the development of good quality. The high qualitative scores of the Karcag experiment are also due to these reasons. The data of Tables 5 and 6 also prove that the high qualitative scores coincide with high scores for hull content.

IV. Hull content of the 25 varieties of the winter wheat varietal collection in Tápiószele ranged in 1962 from 9.24 to 14.09 per cent (Fig. 6.). The difference is important and amounts to 4.85 absolute per cent. Hull content of the

variety *Besostaya 1* was lowest also in this experiment. In 1964 the difference between the scores of the varieties with lowest and highest hull content was 6.52 per cent. In the order of the varieties some changes occurred. Hull content in 1964 was higher than in 1962 for all varieties except *Milturum 553*. Particularly the hull content of the varieties *Prima*, *Mocho de espiga br*, *Bánkúti 1201*, *Saccometti* increased. Since precipitation during the vegetation period was the same in the two experimental years, differences are due first of all to the divergent distribution of precipitation during the vegetation period.

V. From the 25 winter wheat varieties of machine seeding experiments in 1964 generally the Soviet varieties distinguished themselves by lowest hull content (Table 7.) Among these the hull content of *Besostaya* was lowest. The difference in hull content between the varieties of lowest and highest hull content was 3.28 per cent. From the data it can be established that the hereditary low hull content readily manifests itself under favourable conditions. No relationship has been found between the hull content of different varieties, pharinographic scores and thousand grain weight.

Conclusions

Developments of the hull content of wheat according to varieties, fertilizer applications with various dosage rates, stations and other treatments were examined in the quality testing flour laboratory of the Agricultural Research Institute of the Hungarian Academy of Sciences in Martonvásár on the material of experiments with machine seeding and broadcast established at different stations in 1962 and 1964.

On the basis of several experiments it can be stated that the hull content of the variety *Besostaya* is very favourable since it is lowest both according to varieties and treatments. On ten different experimental stations the difference between lowest and highest hull content of the variety *Besostaya* was 2.36 per cent as against 4.66 per cent in the variety *Fertődi 293*.

Under the influence of increasing fertilizer dosage rates the hull content generally increased. The highest increase in hull content and qualitative scores was found in the case of full fertilizer application. While nitrogen given in itself increased both hull content and qualitative scores, full fertilizer application also diminished expansivity of aleuron and thus had a double quality-improving effect.

In the experiment established at ten different stations the hull content developed differently according to the amount and distribution of precipitation and to the soil. On the stations of the Great Hungarian Plain (*Alföld*,) on chernosem soil and under the influence of less precipitation the seed obtained was of better quality but at the same time of higher hull content. On the effect of the various soils and higher amounts of precipitation of the other experi-

mental stations generally a poorer quality but lower hull content developed. The relationship between oceanic climate and higher hull content under conditions of Hungary does not manifest itself in connection with a greater amount of precipitation and higher hull content.

The hull content of 25 different winter wheat varieties which were broadcast, fluctuated in 1962 by 4.85 in 1964 by 6.52 per cent. In 1964, on the other hand the difference between lowest and highest hull content of 25 other varieties was only 3.28 per cent. The data point to the fact that there are substantial differences in the inherited hull content of varieties which, under corresponding conditions, do manifest themselves. Differences of soil and climate and of various fertilizer applications have also an important influence. These factors may change the connections between hull content and some qualitative factors.

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THE PRODUCTION OF WATERMELON F_1 HYBRIDS

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As a result of five year's experiments author succeeded in producing a savoury and productive F_1 heterosis watermelon with small fruit. Combinations that proved to be best of all were obtained from the crossing of the variety of American origin producing small fruit *Dew Green* with the Hungarian variety *Marsowszky* producing large fruit. This hybrid in the state varietal trials was found to be more productive than the existing varieties and obtained preliminary state certification in 1964.

Introduction

In these last 20 years plant breeders have paid, also in the production of vegetables, more and more attention to the breeding of F_1 hybrids. It has appeared that hybrids are of vigorous growth, more hardy, productive and tasty than the pure varieties. To produce hybrid combinations better than the pure varieties is a task which can be accomplished with comparatively easy and simple methods.

Still, a study of Hungarian and foreign varietal catalogues reveals that breeding and production of heterosis vegetables lag behind that of other hybrids.

Breeding of watermelon heterosis hybrids was conducted first of all in Japan (FUJUSHITA 1959, SADA0 1955), USA (ROSA 1925, IVANOFF—ALBRITTON 1962, MOHR et al. 1957, POOLE et al. 1941), the Soviet Union) (BREZHNEV 1959, TKACENKO et al. 1963, ZUEV 1964), Italy (BIANCHI—MARCHESI 1958) and Czechoslovakia (VENENY 1964). Of Hungarian research workers the breeding of the F_1 hybrids of water melon was studied by VIGH (1956), BARNA (1961) and KISS (1965). Workers engaged in the heterosis phenomenon of water melon have almost unanimously established that some combinations are more productive, hardy and savoury than the starting parental varieties (MOHR et al. 1957, SADA0 1955, TKACENKO et al. 1963). IVANOFF—ALBRITTON (1962) found that the most productive F_1 generations were obtained from the crossing of melons with small and large fruit. Unfortunately, however, these heterosis seeds are not available in amounts meeting the demands of growers, because owing to the costly and time-consuming manual crossing method the hybrid seeds produced in small quantities are 6—10 times more expensive than the seeds of pure varieties. In the USA according to MOHR et al. production costs

are ten times, according to SADA0 in Japan six times as high. It is interesting to note that according to SADA0 (1955) in Japan 55.4 per cent of the total area of watermelon is occupied by hybrids. This data indicate that there is a strong reason for the existence of watermelon hybrids in Japan and allow conclusions of possibilities in Hungary.

Material and Method

When breeding heterosis watermelons equally the demands of home consumption and of exports had to be borne in mind (Geneve, Norme Européenne 1964). As recent requirements and particularly export trade demands favoured varieties with small fruit, so, when selecting the crossing partners attention was paid to adequate fruit size at the progeny. We aimed at

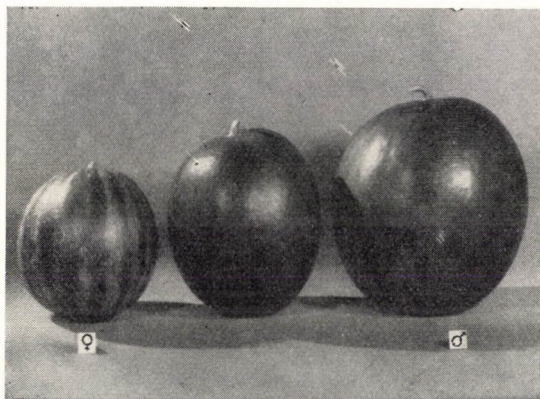


Fig. 1. The Kecskemét F_1 watermelon (in the middle)
♀ Dew Green, ♂ Marsowszky

selecting parent partners from the combination of which watermelons of an average weight of 3—5 kg could be produced (Fig. 1).

In the course of years a total of 122 varieties were collected. Among these finally the few crossing partners were chosen from the progeny of which we intended to select the combination that seemed suitable both for home consumption and exports owing to productivity, flavour and adequate size.

When selecting the parental partners one of the varieties was invariably of small fruit (1—3 kg) but we conducted also crosses where the average weight of both parents ranged from 3 to 4 kg. The large watermelons were used either only as maternal or only as paternal varieties. The F_1 hybrids attained almost without the productivity of the parent producing a richer crop, but only the combinations of the maternal varieties *Dew Green* and *Rhode Island Red* with the paternal variety *Marsowszky* were studied, owing to their properties warranting most favourable fruit size and F_1 hybrid character deriving from the dominance relationship. Also reciprocal crosses were carried out for control, but at maturation the deficiency deriving out of self fertilization could be only established in the former combinations.

Results and Discussion

The first crossing experiments (1959—1960) revealed that from intra-variety hybridization (*Dew Green 1* × *Dew Green 5*, *Rhode Island-1* × *Rhode Island Red-2*) no types more valuable than the parents were obtained

and so we did not continue these experiments in subsequent years. The offspring of the crosses between varieties with small and large fruit (*Dew Green* \times *Marsowszky*, *Rhode Island Red* \times *Marsowszky* were more valuable and more recently *Sugar Baby* \times *Marsowszky*, *Ice Box Red Flesh* \times *Marsowszky* etc.) have proved to be suitable.

Table 1

Watermelon crossing experiment 1960

Combination	Crossed flowers units	Fruit set		Matured fruit	
		units	%	units	%
<i>Dew Green-2</i> \times <i>Marsowszky</i>	62	21	33.8	17	27.4
<i>Marsowszky</i> \times <i>Dew Green-2</i>	20	7	35.0	4	20.0
<i>Rhode Island Red</i> \times <i>Marsowszky</i>	33	12	36.4	7	21.2
<i>Marsowszky</i> \times <i>Rhode Island Red</i>	20	6	30.0	4	20.0

From the crossing experiment it appeared that the fruit setting amounted to 34.2 per cent on the average and fluctuation range was 6.4 per cent. Unfortunately, 19–43 per cent of the fruit set in 10–15 days turned brown and fell off, and this has occurred almost every year. Thus the fruit ratio, as related to the totality of flowers, that subsequently became ripe has not been higher than 23.62 per cent which of course raises the cost of production.

On selecting varieties first of all productivity and adequate fruit size for export was taken into consideration. For instance from the combination *New Hampshire Midget* \times *Marsowszky*, fruit of 1.5 to 3 kg were obtained which owing to the too low fruit size did not meet present requirements (12 per cent of the F_1 hybrids was grade I., of an average weight of 2.5–3.5 kg, 65 per cent grade II. smaller than 2.5 kg and 23 per cent substandard, smaller than 2 kg and shapeless fruit). It should be noted that in our experiment the variety *New Hampshire Midget* produced, in the average of the years, to 85–95 per cent grade II and to 5–15 per cent substandard fruit, first of all on account of the fruit size being exceedingly small, under 1.5 kg.

It is not impossible that in the years to come requirements will favour varieties with still smaller fruit than are in demand at present and then also this variety may be recommended as a crossing partner.

The watermelon of American origin *Dew Green* seemed to be suitable as a maternal crossing partner for several reasons. It is a productive variety with small fruit (1.5–3 kg), its shape is a pleasantly globular, readily storable in ice box, with red flesh and somewhat more savoury than the average. Its rind is of grass-green colour and therefore as a parent with recessive property it seemed particularly reliable as a maternal partner. Unfortunately its pistil-

late flower is hermaphroditic and thus the cost of cross is higher than that of the reciprocal. Medium maturation, ripening 100–115 days after emergence. Very susceptible to fusarium wilt.

Rhode Island Red is a variety of American origin. Similarly to the previous one it produces small fruit, its rind is dark striped on light green ground and thus owing to the recessive property of the rind colour it proved to be a good maternal partner. Very susceptible to fusarium wilt.

Marsowszky is the oldest Hungarian variety with large fruit (10–15) and red flesh. Its flesh is compact, tending to fibrillation. Only the fruit of 4–6 kg are suitable for home consumption and for exportation. A late variety, ripening under favourable weather conditions in 115–125 days, moderately susceptible to fusarium wilt. Hardier and more productive than both American varieties under Hungarian conditions.

Earliness, fruit size, productivity and flavour of the F_1 hybrids were studied in the combination referred to both in 1961 and subsequent years.

In the examination of earliness the appearance of the male and female flower as reckoned from emergence, maturation of the first crop, length of total vegetation period and index of earliness were recorded. The index of earliness indicated the per cent of total yield produced by the hybrids or parent varieties respectively until 15th August (Table 2).

From the early analysis of three years it appeared that our best combination as to earliness was the F_1 hybrid *Dew Green-2* \times *Marsowszky*. Taking the index of earliness at the earlier parent for 100, the earliness of the best combination, gave during years, a value of 123, 112 and 108. The superiority of the hybrid in earliness and productivity appeared also in subsequent years. Productivity of the best hybrids yielded in 1961–1964 the following results (Table 3.).

Unfortunately the results of 1965 cannot be published because our breeding garden has been hail destroyed three times then. From the data it appears, however, that in three years the hybrid *Dew Green-2* \times *Marsowszky* proved to be best of all and only in one year did the more productive *Marsowszky* parent exceed the hybrid. It also appears from the Table that the yields of the various years exhibit a tremendous fluctuation. The two extreme years were 1963 (315.3 q/cad. hold) and 1964 (118.6 q/cad. hold).

While within the year the extreme values of amplitude among varieties and hybrids amount to 24.8–32.5 per cent, the differences among years both within variety and hybrid attain 235–266 per cent fluctuation. These data indicate that in case of unfavourable weather even the productive hybrids may cause deception.

Growers should endeavour to apply under all conditions best cultural practices because even in years unfavourable for watermelon a yield of 100–120 q per cad. hold can be assured by the use of hybrids.

Table 2

*Examination of earliness of F₁ hybrids Kecskeméti
and of parental varieties in 1961–1963*

Variety or combination	Number of days from emergence until appearance of			Index of earliness	Index of earlier parent 100 8
	♂ flower	♀ flower	first crop		
1961					
<i>Dew Green-2</i> × <i>Marsowszky</i>	65	68	115	45.2	123.0
<i>Marsowszky</i> × <i>Dew Green-2</i>	66	70	116	39.5	108.0
<i>Rhode Island Red</i> × <i>Marsowszky</i> ..	65	70	120	38.2	101.0
<i>Marsowszky</i> × <i>Rhode Island Red</i> ..	65	70	121	37.7	99.0
<i>Dew Green-2</i>	68	76	121	36.6	100.0
<i>Rhode Island Red</i>	63	68	119	38.0	100.0
					95.5
<i>Marsowszky</i>	65	71	121	35.0	92.0
1962					
<i>Dew Green-2</i> × <i>Marsowszky</i>	58	63	107	46.5	112.0
<i>Marsowszky</i> × <i>Dew Green-2</i>	58	64	107	43.6	114.8
<i>Rhode Island Red</i> × <i>Marsowszky</i> ..	57	65	108	42.9	102.0
<i>Marsowszky</i> × <i>Rhode Island Red</i> ..	58	66	110	42.0	100.0
<i>Dew Green-2</i>	58	62	104	41.5	100.0
<i>Rhode Island Red</i>	59	61	103	42.0	100.0
					92.0
<i>Marsowszky</i>	57	66	112	38.2	91.0
			—		
1963					
<i>Dew Green-2</i> × <i>Marsowszky</i>	65	69	111	38.1	108.5
<i>Marsowszky</i> × <i>Dew Green-2</i>	66	70	113	36.5	101.5
<i>Rhode Island Red</i> × <i>Marsowszky</i> ..	66	68	112	36.2	101.0
<i>Marsowszky</i> × <i>Rhode Island Red</i> ..	66	68	113	35.9	100.0
<i>Dew Green-2</i>	65	72	116	36.0	100.0
<i>Rhode Island Red</i>	64	68	116	35.9	100.0
					99.5
<i>Marsowszky</i>	66	70	116	35.8	99.7

A positive advantage of hybrid watermelons is the agreeable taste and aroma in fruit flesh. According to our examinations hybrids have a better flavour than any of the parents. For the evaluation of fruit a 20 score system employed. Since in case of watermelon the flavour of fruit is considered as

Table 3
Productivity of F_1 hybrids and parents in 1961—1963

Variety or combination	1961	1962	1963	1964	4 year average	Relative number
	q/cad. hold					
<i>Dew Green-2</i> × <i>Marsowszky</i> ..	163.0	175.0	315.3	118.6	192.97	103.0
<i>Marsowszky</i> × <i>Dew Green-2</i> ..	160.5	171.3	306.2	115.0	188.25	100.2
<i>Rhode Island Red</i> × <i>Marsowszky</i>	140.7	135.8	252.0	99.6	157.05	84.0
<i>Marsowszky</i> × <i>Rhode Island Red</i>	133.0	140.2	275.5	107.0	163.92	86.8
<i>Dew Green-2</i>	135.1	161.5	291.0	100.2	171.95	91.5
<i>Rhode Island Red</i>	118.5	122.4	235.1	93.8	142.45	76.0
<i>Marsowszky</i>	167.1	166.0	300.4	118.3	187.95	100.0
S D 5%	9.8	15.5	24.2	7.4		

most important, in evaluation this feature obtains the highest figure and gradually lower numbers are assigned to the flesh colour fruit size and fibre content of the flesh. Maximum score of the fruit corresponding to highest demands will be 20, while the perfectly worthless watermelon is marked with 4. Table 4 presents the scores for hybrids and parental varieties examined in 1961—1963.

From the Table it appears that taste and flavour value of the combination *Dew Green-2* × *Marsowszky* was better than that of both parents (7.13 on the average of 3 years, while in the case of the better parent only 6.13). Fruit shape, flesh colour and flesh fibrillation values do not exhibit such important difference but the total score of the best hybrid was 14.55 while that of the best parent 13.12.

In the 1963 and 1964 national trials this hybrid as to productivity exceeded the constant varieties. Its savoury fruit of small to medium large size was considered as suitable for exportation and the quality was found to be better than that of the old land races. The opinion of the competent institute was as follows:

“An early hybrid maturing though a few days later than *Sugar Baby* but in the second week of maturation considerably overtaking the latter. Owing to its healthy foliage it can be picked for a longer period and yields also

Table 4

Variety or combination	Years	Size	Colour of flesh	Fibre content of flesh	Taste, flavour	Taste, scores	Average weight kg
	of the fruit						
<i>Dew Green-2</i> × <i>Marsowszky</i>	1961	2.9	2.2	2.1	7.3	14.5	3.6
	1962	3.0	2.4	2.0	6.6	14.0	3.9
	1963	2.9	2.7	2.1	7.5	15.2	4.2
	\bar{X}	2.93	2.43	2.06	7.13	14.55	3.90
<i>Marsowszky</i> × <i>Dew Green-2</i>	1961	2.9	2.0	2.0	6.5	13.4	3.8
	1962	2.8	2.1	1.9	6.2	13.0	4.0
	1963	2.8	2.2	2.1	6.8	13.9	4.2
	\bar{X}	2.83	2.1	2.0	6.5	13.43	4.00
<i>Rhode Island Red</i> × <i>Marsowszky</i>	1961	2.7	2.4	2.0	6.6	12.7	3.7
	1962	2.5	2.5	2.2	6.2	13.4	4.1
	1963	2.6	2.4	2.1	6.3	13.4	4.4
	\bar{X}	2.6	2.4	2.1	6.0	13.10	4.06
<i>Marsowszky</i> × <i>Rhode Island Red.</i>	1961	2.8	2.6	1.9	5.3	12.6	3.8
	1962	2.3	2.5	2.1	6.1	13.0	3.9
	1963	2.7	2.6	2.1	6.6	14.0	4.5
	\bar{X}	2.6	2.56	2.03	6.0	13.19	4.06
<i>Dew Green-2</i>	1961	1.6	2.4	2.6	5.8	12.4	2.1
	1962	1.4	2.5	2.5	5.2	11.6	2.1
	1963	1.4	2.6	2.6	5.8	12.4	2.3
	\bar{X}	1.46	2.5	2.56	5.6	12.12	2.16
<i>Rhode Island Red</i>	1961	2.7	2.1	2.0	5.4	12.2	2.9
	1962	2.5	2.0	2.1	5.0	11.6	3.3
	1963	2.6	2.1	2.2	5.5	12.4	2.4
	\bar{X}	2.6	2.06	2.1	5.3	12.06	3.20
<i>Marsowszky</i>	1961	2.7	2.7	1.9	5.8	13.1	5.6
	1962	2.6	2.4	1.8	6.1	12.9	5.5
	1963	2.5	2.5	1.9	6.5	13.4	6.3
	\bar{X}	2.6	2.53	1.86	6.13	13.12	5.80

later on fruit of good quality. Seed production of greater proportions and growing on farm-scale is justified."

The hybrid obtained preliminary state certification in 1964.

The cooperative farm *Kossuth* of *Nagykarácsony* verified the rentability of the production of water-melon "*Kecskeméti heterozis*" on the farm level. Comparative growing was conducted with the hybrid from 1963 every year on 2 to 4 cad. hold. In these examinations the watermelon varieties *Sugar Baby* and *Marsowszky* were included. Experience gained in the growing was formulated as follows:

"The watermelon „*Kecskeméti heterozis*" in the picking from each fruit setting gave a larger mass than *Sugar Baby* and thus its Forint yield from one cad. hold was 4000 Ft. higher. The shape of the fruit is moderately globular, oval, elongated, with an average weight of 4–5 kg. Its taste, colour and transportability are excellent, it is highly suited for exportation."

In the presentation of yields at the Agricultural Exhibition in Budapest 28 August 1964 this hybrid gained I. prize, while at the International Horticultural Exhibition of Vienna 11 October 1964 it obtained a silver medal.

The production of the F_1 watermelon seed is, at present, 3.5 to 4 times as expensive as that of the pure variety. Of course the higher price prevents growers from purchasing hybrid seed until they get acquainted with the superiority of the heterosis watermelon.

The seed firm BURPEE advertises one ounce (28.35 g = abt. 500 seeds) of heterosis watermelon seed at a price of 10 dollars. The Japanese firms sell the diploid heterosis seed at a similar price. It should be noted that the price of the *Sugar Baby* watermelon seed is only 65 cent per oz. thus it is sold at a 15 times lower price than the F_1 hybrid seed.

The maternal and parental partners are planted in double rows in an alternating order so that half of the area is occupied by the maternal, the other half by the paternal rows. Thus crossing can be carried out easier. In Japan the paternal variety is 10 per cent whereas in the USA 25 per cent.

According to our observations made up to present a trained worker can carry out crosses only for 4 hours daily. From these 4 hours selection and isolation of female and male flowers in the late afternoon take 2 hours while the other two hours are spent the next morning between 6 and 8 o'clock on castration and pollination. In the average of the years 1964–65 the fruit setting fluctuated around 50–66 per cent but only too often fruit set, in egg-size condition, turned black and dried out.

In case of favourable weather mature fruit was obtained from 50 per cent of the crossed flowers while having a cool, rainy summer, such as prevailed also in 1965, only from 30–33 per cent.

In 1965 six trained workers crossed 1800 flowers from which 1200 fruit were set (66 per cent). Of the fruit set, however, 600 in the 10–15 days after

pollination turned black and fell off. Thus from the 1800 flowers crossed finally only 600 fruit matured the total amount of seed of which was 9.5 kg. The result of one hour's useful work of a worker was 43—45 g seed (exactly 44 g, in case of a thousand grain weight of 50 g 880 seeds). This amount is found in about 3 hybrid melons.

Through the 1 hour work of a trained worker an area of about 1200—1400 m² can be planted with heterosis water-melon. (The germinative capacity of the seed was 99 per cent but 10—12 per cent of seedlings has perished on the average of the years).

The crossing technique can still be improved but it is hardly imaginable that performance could be doubled in the near future. Unfortunately the work of crossing is bound to a certain period of the day. During day time in warm sunny weather pollination is followed by poor fruit setting and only in the crosses carried out early in the morning (between 5 and 8 o'clock) is the fruit setting satisfactory. In case of cool humid weather the pollen is only suited for pollination between 9 and 11 o'clock.

In seed production the variety disposing of recessive properties (light green rind) *Dew Green-2* is used as a maternal parent, owing to the reliability of crossing. In this variety, however, the pistillate flowers are hermaphroditic and so the anther must be removed before crossing. This is disadvantageous for two reasons. On the one hand crossing takes more time and on the other disease is spread by castration and thus the number of fruit settings diminished.

We have already succeeded in fixing individuals with female flowers by selfing and hope to obtain useful combinations also with this strain. With this type castration necessary now for the production of the hybrid can be saved.

SADAO (1955) in the production of F₁ hybrid seed recommends the method of "sex expression". From the parent varieties planted in parallel rows and used as mother plants the male flowers must be removed. So with natural pollination hybrid seed is obtained. In our case this method can be employed when the value of the line *Dew Green-2* with purely female flowers has been evaluated and the new type propagated. In our opinion this method requires very thorough and careful work because male flowers arise continuously and in a great number. Supposing perfunctory work the number of seeds from selfing will be rather high.

Another suitable method used by several authors especially in cucumber is the production of gynoeceious lines (KÖRÖS 1965). In this case the maternal variety produces only female flowers and thus the production of the hybrid in the case of proper spatial isolation could be carried out also in the fields with natural pollination by insects.

In both cases it is to be desired for the maternal variety, beside securing the recessive gene, to build in a marker character that would indicate already

in the cotyledone age the hybrid character of the seedling. Because of the higher cost of seed production it is necessary to increase the export price of the guaranteed savoury F_1 watermelon fruit by at least 1 Ft per kg as this is the only way to assure the grower the higher income corresponding to the higher seed price.

After Japanese workers we have also succeeded in realizing the F_1 seed production by triploidy.

Conclusions

Work directed to the production of heterosis watermelon was started in spring 1959 by the analysis of parents and the production of single combinations.

In the course of years 122 varieties were studied and finally the F_1 hybrids from the cross of the variety *Dew Green-2* with small fruit and *Marsovszky* with large fruit was found best of all. The maternal variety on account of its small fruit and the paternal variety on account of its large fruit were suitable for export to a lesser extent. From the hybrid combination of the two varieties and early savoury and productive F_1 generation with fruit of 3–5 kg well suited for exportation was obtained, which assured in large-scale production higher rentability than the early *Sugar Baby* variety.

The index of earliness of the most valuable F_1 was on the average of 1961–1963 43.3 while for *Dew Green-2* 38.0 and for *Marsovszky* 36.3. (The index of earliness indicated the per cent of total yield obtained from the hybrid and the parents respectively prior to August 15th.) This hybrid exceeded in the average of years the more productive parent by 3 per cent and the less productive one by 11.5 per cent. It proved to be more productive than any other variety also in the national trials and therefore obtained preliminary state certification in 1964.

In 1964 the F_1 heterosis hybrid Kecskenéti obtained a first prize at the Agricultural Exhibition in Budapest and a silver medal at the International Horticultural Exhibition in Vienna.

Seed production is carried out by manual crossing. Maternal and paternal parents are planted in double rows in alternating order so that half of the area is occupied by the maternal, the other half by the paternal variety. A trained worker can carry out crosses only for 4 hours daily including 2 hours in the late afternoon for selection and isolation of flowers and two hours between 6–7 or 6–8 early in the morning for castration, pollination and isolation.

Fruit setting, in the case of manual crossing amounts to about 50–66 per cent on the average of years but only from 30 to 50 per cent of the fruit set is obtained mature yield. Thus the final result of 1 hour's useful work of a worker is about 43–45 g of seeds which is found in about 3 hybrid melons.

The cost of production of the hybrid seed is 3.5 to 4 times as high as that of the diploid pure variety.

In our opinion, on account of the more expensive seed it is perfectly justified that the exportation price of the warranted savoury hybrid watermelon should be fixed at least 1 Ft higher per kg.

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RESULTS OF THE FIRST EXPERIMENTS IN FARM TECHNOLOGY CONCERNING HYBRID SUDAN GRASS IN HUNGARY

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In 1963 and 1964 investigations were conducted on the first Hungarian hybrid Sudan grasses (*Hybar Mv 301*, *Hybar Mv 309*) to determine their value in cultivation. Yield of the hybrid Sudan grasses was compared with that of the Sweet Sudan grass used as a standard, at 4 seeding dates (20. IV, 4. V, 18. V, 1. VI.).

According to experimental results on the average of 2 years and 4 seeding dates from *Hybar Mv 301* 37.3 per cent, from *Hybar Mv 309* 31.9 per cent higher green yield was obtained as compared with the sweet Sudan grass.

The optimum seeding date under the given conditions is when the soil has warmed up to the depth of seeding (4—5 cm) at least to 14—15° C.

Introduction

Before describing the experiments the position of Sudan grass production in Hungary should be briefly reviewed.

In Hungary, SURÁNYI (1926) was the first to conduct experiments with the seeds obtained from the USA, in 1925. Although initial attempts were successful, growing at first could not gain ground, which was due, in our opinion, to the lack of proper varieties and the farm technology that had not yet been elaborated. After World War II production gained a new momentum when the sweet Sudan grass appeared, and were discussed more extensively by SURÁNYI (1951, 1956) and BAJAI (1961).

Breeding work starting in the middle of the fifties marked a new stage in the growing of Sudan grass. Its result was the first European and Hungarian hybrid (*Hybar Mv 301*) bred simultaneously with the American hybrid Sudan grasses which is 30—40 per cent more productive than sweet Sudan grass (BARABÁS 1961, 1964).

In the meantime the most important issues of farm technology were successfully worked out. So in our days we have already elucidated the most important causes of injurious after-effects and the possibilities of their elimination (KÜKEDI 1961, 1962). It has been also established that manure reaction of hybrid Sudan grass is substantially better under our given conditions than that of green maize (BAJAI et al. 1962, KÜKEDI 1964) and with rational fertilizer application its yield can be enhanced even by 60 per cent (KÜKEDI 1962). Optimum seed quantity (KÜKEDI 1963) and seeding dates

(KÜKEDI 1964) were established and considerable results obtained in chemical weed control.

Since practical farming became acquainted with Sudan grasses, interest for them has been intensified in these last years. Their dissemination is limited, however, by the lack of stock seed. Thus, at present from the 5 800 000 hectare arable land of the country Sudan grass is grown only on 10 000 hectare.

We will now approach the subject of the experiments with the first Hungarian hybrid Sudan grasses.

Experimental Procedure

Investigations were carried out at Martonvásár, in the Agricultural Research Institute of the Hungarian Academy of Sciences on chernosem soil with wood rests, in collaboration with the head of the scientific department (National Institute of Agrobotany, Tápiószéle), GY. MÁNDY in the years 1963 and 1964. The most characteristic data on the basis of laboratory analysis carried out in this Institute are as follows:

pH in the surface soil 6.86 (KCl) 6.85

pH in the subsoil 7.18

humus content 3.5 per cent

total nitrogen 2.35 per cent

number of stiffness (sticky point) according to Arany 42

thickness of the humus layer 60 cm.

It may be useful to quote also the most important meteorological data, according to the local Agrometeorological Observatory (Table 1).

The factorial experiment was established in split-plot layout, with 4 replications, on 10 m² plots in the first and 15 m² plots in the second year, with the following treatments:



Fig. 1. Detail of the experiment, left: *Hybar Mv 301*, centre: *common Sudan grass*.

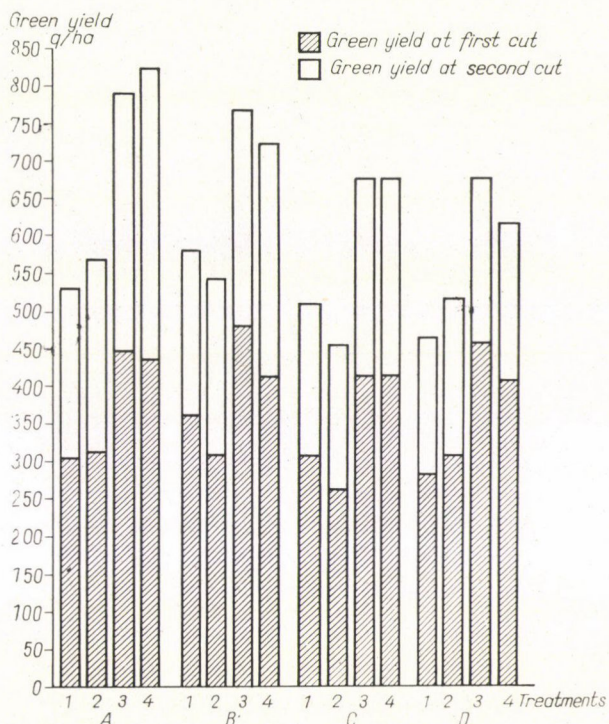


Fig. 2. Green yield of Sudan grasses depending on seeding date (1963)

Key to symbols used

- A) Seeding date A) 20. IV 1963
 B) Seeding date B) 4. V 1963
 C) Seeding date C) 18. V 1963
 D) Seeding date D) 1. VI 1963

1. Sweet Sudan grass
 2. Common Sudan grass
 3. Hybar Mv 301
 4. Hybar Mv (309)

Seeding dates

1. 20. IV.
 2. 4. V.
 3. 18. V.
 4. 1. VI.

Varieties, hybrids

1. Sweet Sudan grass
 2. Common Sudan grass
 3. Hybar Mv 301
 4. Hybar Mv 311 (309)

The experimental area was both years given 350 q/ha farmyard manure in autumn and 70 kg/ha N in spring. The soil was prepared with the utmost care so that it was perfectly free of weeds at seeding which was carried out in drills with the width usual for cereals at the above dates as well as 30 sprouts came on a running metre. The seeds sown emerged depending on temperature and moisture content of the soil within 5 to 14 days. After emergence (1963) no care of plants was applied in the first year because the soil was left free of weeds but in the second year 1.75 kg/ha Atrazin was postemergently used. In the experiment the stand was complete in both years and the crop showed a good development up to harvesting which took place on the days indicated in Table 2. Immediately before harvesting in 1964—5 leaf to stem ratio was examined for all seeding dates. Table 3 presents these data while Table 4 the 2 year

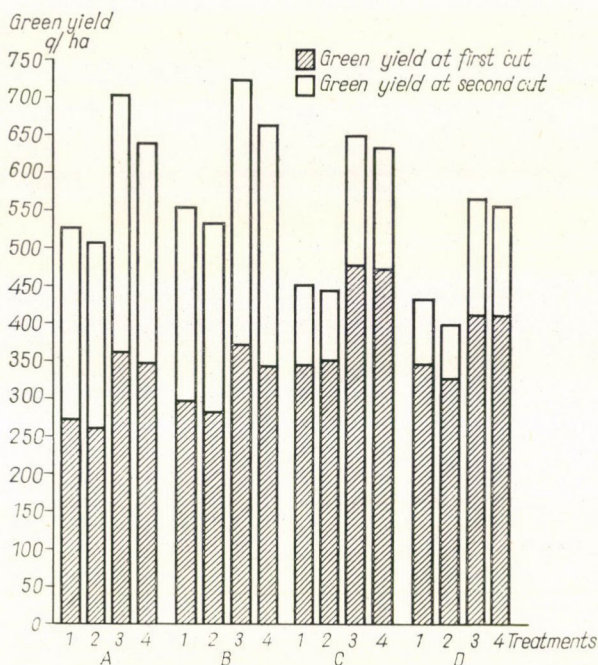


Fig. 3. Green yield of Sudan grasses depending on seeding date (1964)

Key to symbols used

- A) Seeding date A) 20. IV 1963
 B) Seeding date B) 4. V 1963
 C) Seeding date C) 18. V 1963
 D) Seeding date D) 1. VI 1963

1. Sweet Sudan grass
 2. Common Sudan grass.
 3. Hybar Mv 301
 4. Hybar Mv 309

means of green crop. In Table 5 the data of yields converted to absolute dry matter are seen, equally in the 2 year average.

Fig. 1 shows a detail of the experiment while on Figs. 2 and 3 the green crops of 1963 and 1964 are seen.

Results and Discussion

In Table 1 showing the meteorological data it appears that in 1963, from April to September (except for April, August and September) the temperature was around the 40 year means, while in the above 3 months it was higher by 1.9, 1.0 and 2.3° C. Next year (1964) April and June were warmer than the average but in May, July and August the weather was cooler by 0.2, 0.3 and 1.9° C as compared with the 40 year means.

Analysing the data on the distribution of precipitation we find to have a 13 and 27 mm deficit in April and May 1963 as compared with the 40 year average whereas in the summer months precipitation was abundant (a surplus against the average of 36 mm in June, 14 in July, 14 in August and 40 in September) being very favourable for Sudan grasses.

Table 1
Meteorological data (precipitation mm, temperature °C)
 (1963—1964)

Year	Precipitation mm							Temperature °C						
	IV.	V.	VI.	VII.	VIII.	IX.	total during veg. period	IV.	V.	VI.	VII.	VIII.	IX.	Average
1963.....	33	39	98	64	66	92	392	12.0	15.9	19.7	22.2	21.7	18.0	18.3
1964.....	37	32	145	55	68	24	361	11.9	15.7	22.1	21.2	18.8	15.8	17.6
Mean 1901—1940	46	66	62	50	52	52	328	10.1	15.9	19.1	21.5	20.7	15.7	17.1
Deviation from the mean														
1963	—13	—27	36	14	14	40	64	1.9	—	0.6	0.7	1.0	2.3	1.2
1964.....	— 9	—34	83	5	16	—28	33	1.8	—0.2	3.0	—0.3	—1.9	0.1	0.4

Table 2
Harvesting date of Sudan grasses
(1963, 1964)

Serial No	Seeding date	Hybrid, variety	Date of harvest 1963		1964		Number of days from seeding to cutting in the 2 year average	
			main	regrowth	main	regrowth	main	regrowth
1.	20. IV	<i>Sweet Sudan grass</i>	3. VII	16. VIII	1. VII	16. VIII	72	117
2.	0. IV	<i>Common Sudan grass</i>	3. VII	16. VIII	1. VII	16. VIII	72	117
3.	20. IV	<i>Hybar Mv 301</i>	3. VII	16. VIII	1. VII	16. VIII	72	117
4.	20. IV	<i>Hybar Mv 311 (309)</i>	3. VII	16. VIII	1. VII	16. VIII	72	117
5.	4. V	<i>Sweet Sudan grass</i>	8. VII	17. VIII	3. VII	16. VIII	60	104
6.	4. V	<i>Common Sudan grass</i>	8. VII	17. VIII	3. VII	16. VIII	60	104
7.	4. V	<i>Hybar Mv 301</i>	8. VII	17. VIII	3. VII	16. VIII	60	104
8.	4. V	<i>Hybar Mv 311 (309)</i>	8. VII	17. VIII	3. VII	16. VIII	60	104
9.	18. V	<i>Sweet Sudan grass</i>	17. VII	29. VIII	18. VII	1. IX	59	104
10.	18. V	<i>Common Sudan grass</i>	17. VII	29. VIII	18. VII	1. IX	59	104
11.	18. V	<i>Hybar Mv 301</i>	17. VII	29. VIII	18. VII	1. IX	59	104
12.	18. V	<i>Hybar Mv 311 (309)</i>	17. VII	29. VIII	18. VII	1. IX	59	104
13.	1. VI	<i>Sweet Sudan grass</i>	26. VII	10. IX	23. VII	28. IX	52	109
14.	1. VI	<i>Common Sudan grass</i>	26. VII	10. IX	23. VII	28. IX	52	109
15.	1. VI	<i>Hybar Mv 301</i>	26. VII	10. IX	23. VII	28. IX	52	109
16.	1. VI	<i>Hybar Mv 311 (309)</i>	26. VII	10. IX	23. VII	28. IX	52	109

Note: The mark of *Hybar Mv 311* is now *Hybar Mv 309*

In the next year, 1964, precipitation was again deficient in April and May, by 9 and 34 mm whereas in later months, with the exception of September again, precipitation was higher than the 40 year average, as a result the crops developed favourably and yields were rather high.

Summing up meteorological data, both years may be considered as favourable for Sudan grass production.

From the data of Table 2 presenting harvesting dates it appears that both in 1963 and 1964 the harvesting dates belonging to the first two seeding dates (20. IV, 4. V.) fell very near to each other. This was due to the low temperature at the end of April which hampered emergence. Therefore with the first seeding date in the 2 year average 72 days passed until panicle emergence of *common Sudan grass* i.e. until the beginning of the harvest. With the second seeding date this period was shortened to 60 days. At the third and fourth seeding date the days from seeding to harvesting numbered 59 and 52 respectively. So the data seem to point out that an early (20 April) seeding date does not, under our given conditions, come up to expectations and earlier seeding does not involve earlier harvesting.

Table 3
Leaf to stem ratio in Sudan grasses
(1964)

Serial	Seeding date	Hybrid, variety	Percentual ratio			
			Main crop		Regrowth	
			green leaf	green stem	green leaf	green stem
1	20. IV	<i>Sweet Sudan grass</i>	30	70	30	70
2	20. IV	<i>Common Sudan grass</i>	28	72	30	70
3	20. IV	<i>Hybar Mv 301</i>	36	64	35	65
4	20. IV	<i>Hybar Mv 311 (309)</i>	32	68	34	66
5	4. V	<i>Sweet Sudan grass</i>	36	64	31	69
6	4. V	<i>Common Sudan grass</i>	34	66	37	63
7	4. V	<i>Hybar 301</i>	38	62	38	62
8	4. V	<i>Hybar Mv 311 (309)</i>	34	66	40	60
9	18. V	<i>Sweet Sudan grass</i>	29	71	38	62
10	18. V	<i>Common Sudan grass</i>	28	72	41	59
11	18. V	<i>Hybar Mv 301</i>	31	69	44	56
12	18. V	<i>Hybar Mv 311 (309)</i>	30	70	45	55
13	1. VI	<i>Sweet Sudan grass</i>	30	70	37	63
14	1. VI	<i>Common Sudan grass</i>	28	72	41	59
15	1. VI	<i>Hybar Mv 301</i>	31	69	45	54
16	1. VI	<i>Hybar Mv 311 (309)</i>	30	70	46	55

Note: The mark *Hybar Mv 311* is now *Hybar Mv 309*

The cutting dates of regrowth were naturally dependent on the dates of first cuts, consequently the highest number of days from seeding to cutting of regrowth were found in case of the first seeding date. Later on, these cutting dates depended mainly on the amount of precipitation and on temperature.

According to the data of Table 3 showing leaf to stem ratio of Sudan grasses, this ratio was with all 4 seeding dates better at the first cut for *Hybar Mv 301* than for the varieties.

In 1964—5, leaf per cent of *sweet Sudan grass*, as most generally grown variety in Hungary fluctuated in the main crop i.e. at the first cut between 29 and 36 per cent for the 4 seeding dates, while the corresponding number for *Hybar Mv 301* was 31 to 38 per cent.

The leaf ratio of the *common Sudan grass* grown earlier in Hungary was lower than that of the sweet variety, being between 28 and 34 per cent according to the 4 seeding dates.

At the second cut i.e. in the regrowth *Hybar Mv 301* gave again the greatest leaf mass per unit area (between 35 and 45 per cent for the 4 seeding dates) while *sweet Sudan grass* lagged behind over again (30—38 leaf per cent). It is remarkable at the same time that *common Sudan grass* has proved to be better in this respect than the sweet one (30—41 leaf per cent). Leaf to stem ratio or per cent was very favourable in our experiments of 1964. According to our experience, however, this may change to a higher or lesser degree depending on soil type, nutritional status and weather. After a review of leaf to stem weight ratio we will examine the Figures representing the crop yields of 1963 and 1964 and the Tables covering the 2 year's averages.

According to Fig. 2 showing the green yields of 1963, *Hybar Mv 301* proved to be better at the first cut than the varieties also in productivity, surpassing them in yield by 100 q per hectare in most cases and in some even more. This surplus yield fluctuated between 113 and 162 per cent as expressed in relative numbers. The greatest difference in yield occurred between the hybrids and the *sweet Sudan grass* with the 4th seeding date (I. VI) when it was 62 per cent in favour of *Hybar Mv 301* and 43 per cent in favour of *Hybar Mv 309*.

At the second cut i.e. regrowth hybrid Sudan grasses occupied repeatedly the first places with a surplus yield of 19—71 per cent (4th seeding date) as compared with *sweet Sudan grass*. Hybrids give, however, really high regrowth yields according to our observations, when first cut takes place long before panicle emergence. They are more susceptible to belated cutting than the varieties.

Summing up the yield data of the 2nd cut the hybrid Sudan grasses gave a 24—55 per cent higher yield than standard variety *sweet Sudan grass* for the 4 seeding dates. Yield differences are significant.

Table 4
Green yield of Sudan grasses in the 2 year average
 (1963—1964)

Serial	Treatment (seeding, variety, hybrid)	Green yield q/ha	Relative number
1	20.IV <i>Sweet Sudan grass</i>	530.0	100.0
2	20.IV <i>Common Sudan grass</i>	537.5	101.4
3	20.IV <i>Hybar Mv 301</i>	745.8	140.7
4	20.IV <i>Hybar Mv 311 (309)</i>	729.0	137.5
5	4.V <i>Sweet Sudan grass</i>	567.8	100.0
6	4.V <i>Common Sudan grass</i>	537.5	94.6
7	4.V <i>Hybar Mv 301</i>	744.5	131.1
8	4.V <i>Hybar Mv 311 (309)</i>	691.0	127.7
9	18.V <i>Sweet Sudan grass</i>	477.3	100.0
10	18.V <i>Common Sudan grass</i>	447.4	93.7
11	18.V <i>Hybar Mv 301</i>	659.0	138.4
12	18.V <i>Hybar Mv 311 (309)</i>	654.0	137.0
13	1.VI <i>Sweet Sudan grass</i>	444.0	100.0
14	1.VI <i>Common Sudan grass</i>	454.0	102.2
15	1.VI <i>Hybar Mv 301</i>	617.5	139.0
16	1.VI <i>Hybar Mv 311 (309)</i>	584.1	131.5
	S D 95% (seeding date, variety)	21.40	4.03
	S D 99% (seeding date, variety)	28.60	5.39
	S D 99.9% (seeding date, variety)	37.60	7.09
	S D 95% (between combination)	43.60	8.22
	S D 99% (between combination)	58.26	10.99
	S D 99.9% (between combination)	76.66	14.46

Note: The mark of *Hybar Mv 311* is now *Hybar Mv 309*

The yield data of 1964 are in many respects similar to those of 1963 since both at first and second cut hybrid Sudan grasses gave significantly higher yields than *sweet Sudan grass* used as standard variety. E.g. *Hybar Mv 301* surpassed it at the first cut by a surplus yield fluctuating between 19 and 39 per cent for the 4 seeding dates; while in the second cut the excess was 34—77 per cent. Yield obtained from the two cuts was 31—45 per cent higher than that of *sweet Sudan grass*.

After having discussed the yields of the two years in detail we are going to evaluate the results in Table 4 showing summarized averages of the yields of 2 years.

Table 5
Yield of Sudan grasses as related to absolute dry matter
 (1963—1964)

Serial	Seeding	Hybrid, variety	Yield q/ha						2 year average main + regrowth	%
			1963			1964				
			main	re-growth	total	main	re-growth	Total		
1	20. IV	<i>Sweet Sudan grass</i>	52.2	43.1	95.3	54.8	45.7	100.5	97.9	100.0
2	20. IV	<i>Common Sudan grass</i>	59.6	50.7	110.3	54.7	47.0	101.7	106.0	108.2
3	20. IV	<i>Hybar Mv 301</i>	72.0	64.6	136.6	65.0	57.9	122.9	128.7	132.5
4	20. IV	<i>Hybar Mv 311 (309)</i>	72.0	73.0	145.5	66.0	50.3	116.3	130.9	133.7
5	4. V	<i>Sweet Sudan grass</i>	64.9	37.4	102.3	47.0	49.6	96.6	99.4	100.0
6	4. V	<i>Common Sudan grass</i>	61.4	44.4	105.8	47.7	50.8	98.5	102.1	102.7
7	4. V	<i>Hybar Mv 301</i>	76.9	45.9	122.8	54.1	64.9	119.0	120.9	121.6
8	4. V	<i>Hybar Mv. 311 (309)</i>	68.3	52.2	120.5	52.8	59.3	112.1	116.3	117.0
9	18. V	<i>Sweet Sudan grass</i>	55.2	32.0	87.2	52.8	19.2	72.0	79.6	100.0
10	18. V	<i>Common Sudan grass</i>	49.4	34.8	93.6	55.6	17.8	73.4	83.5	104.9
11	18. V	<i>Hybar Mv 301</i>	70.3	44.2	114.5	71.1	29.5	100.6	107.5	135.0
12	18. V	<i>Hybar Mv 311 (309)</i>	72.4	45.5	117.9	72.5	29.2	101.7	109.8	137.9
13	1. VI	<i>Sweet Sudan grass</i>	50.4	28.8	79.2	54.5	16.5	71.0	75.1	100.0
14.	1. VI	<i>Common Sudan grass</i>	61.4	35.2	96.6	54.5	13.9	68.4	82.5	109.8
15	1. VI	<i>Hybar Mv 301</i>	77.1	33.0	110.1	61.1	27.6	88.7	99.4	132.4
16	1. VI	<i>Hybar Mv 311 (309)</i>	70.1	33.1	103.2	63.2	27.2	90.4	96.8	128.9

Note: The mark of *Hybar Mv 311* is now *Hybar Mv 309*

At all 4 seeding dates yields were related here separately to those of the *sweet Sudan grass* used as standard variety. According to data the surplus yield of *Hybar Mv 301* was for the 4 seeding dates and in the 2 year average with 37.2 per cent significantly higher. *Hybar Mv 309* with its equally significant excess yield of 31.9 per cent did not lag behind much either in this respect.

The developments of the yield depend, however, not only on varieties but also on seeding dates since the data revealed that both varieties and hybrids gave lower yields with the 3rd, and 4th seeding date (with sown 18. V and 1. VI) than with the first two (20. IV, 4. V). The reduced yields are due,

first of all, to the regrowth. At the second seeding date, (which is considered as optimum in our conditions) the yield of the regrowth of *sweet Sudan grass* was 73.6 per cent of the main crop in the 2 year average, while at the 1st, June seeding date only 43 per cent. Things are the same with *Hybar Mv 301* where in the 4. V seeding regrowth was 76.9 per cent of the main crop. to drop to 43.4 per cent with the 1. VI seeding.

Having reviewed the results of green yields now we are coming to assessing the data of yields converted to absolute dry matter.

These results also demonstrate that hybrid Sudan grasses surpass significantly the varieties in both experimental years at the first cut as well as at the second. These differences expressed in relative numbers range in the 2 year average from 17 to 38 per cent.

Depending on seeding dates we again obtained lower yields with the 3rd and 4th seeding date.

Conclusion

Farm technological investigations were conducted with the first Hungarian hybrid Sudan grasses 1963 and 1964 (*Hybar Mv 301*, *Hybar Mv 309*) by the Martonvásár Agricultural Research Institute of the Hungarian Academy of Sciences on chernosem soil with rests of woods. The yields of the hybrid Sudan grasses with 4 different seeding dates (20. IV, 4. V, 18. V, 1. VI.) were compared with that of the *sweet Sudan grass* used as a standard variety.

On the basis of the results it was established that *Hybar Mv 301* supplied, in the average of 2 years and 4 seeding dates a 37.3 per cent higher yield than *sweet Sudan grass*. Its initial growth, leaf to stem ratio is better than in the standard variety.

Optimum seeding date of the hybrids — under our given conditions — is in early spring the last third of April, but more the first half of May when the soil is warmed up to 14–15° C.

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ENSILATION EXPERIMENTS WITH PULPED LUCERNE

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Experiments have been conducted with pulped lucerne in order to find out whether by this method a silage of good quality may or may not be prepared for pigs. It has been stated that pulping is not a suitable method for the ensilation of lucerne either.

Introduction

According to many experimental results the feeding of pulped lucerne proved to be advantageous in summer feeding of pigs. The question aroused whether by pulping from the lucerne of high biological value as well as of considerable protein and carotine content a silage of good quality could be prepared for pigs or not. Silage would render the winter feeding of pigs more natural, more variegated and cheaper, similar to summer forage, supplying animals continuously with green fodder for the whole year.

By pulping the material to be ensilaged it was partly intended to provide more perfect anaerob conditions by higher-grade compression and, on the other hand, to ensure an adequate quantity of substances suitable for fermentation by releasing the cell-sap. In this manner the requirements of lactous fermentation at low temperature should be met.

Despite of many-sided experiments the ensilation of lucerne could not satisfactorily be solved by the research workers so far.

Ensilation of pulped lucerne has been based on the evidence of the Wageningen (Holland) Agricultural College, Institute of Technology (LENINGER 1957), pointing out that nearly all green fodders contain sufficient fermentable substances, but these are not suitable for immediate digestion. According to this Institute, silages of excellent quality may be prepared by pulping at the cost of very small losses. KÄSTLI—SCHOCH (1953) reporting on earlier experiments in Switzerland, alluded to some research workers, who had attempted to ensile ground green fodder, but this method did not yield the expected result either. At the beginning of the experiment the formation of lactic acid was very vigorous, but later during the storage its amount decreased considerably, and large quantities of butyric acid developed. In the twenties and thirties the idea of pulping was also raised in Hungary. With a pulping machine

constructed by the firm *László and Son*, lucerne was pulped and subsequently ensiled in the estate of *L. Förstner*, in 1948. The silage produced by this way showed the following characteristics: pH = 4.03, lactic acid content = 2.19 per cent, acetic acid content = 1.14 per cent, dry matter proportion = 28.6 per cent, starch value = 9 kg and the rate of digestible protein = 1.5 per cent, respectively. It was a mash of tiny pieces and identical with the original material, had a green colour and a smell reminding of fresh grass. The ensilation experiment of MENTLER (1963) with pulped sainfoin cut down at the beginning of efflorescence gave favourable results as well.

Detailed data of ensilation experiments carried on by RUSCHMANN with pulped lupine, fodder beet leaves and seradella are to be found in the paper of MÁRKUS (1939). RUSCHMANN reports on very favourable results. After twenty weeks of fermentation the colour, smell and tissue structure of pulped fodders were the same as immediately after pulping; they reminded more of the original raw material than of fermented one. Beside a small acid content these fodders had a relatively low pH-value, indicating that up to a hydrogen ion concentration of about 4.1 to 4.3 providing by all means conservation, only a small amount of carbohydrates was consumed for lactic acid production. According to RUSCHMANN's bacteriological investigations nearly pure lactous fermentation took place in the pulps. Lactobacilli paralysed — probably due to their rapid propagation — the lifefunctions of all other bacterium species being therefore almost entirely absent from the material examined. In the opinion of MÁRKUS by pulping even fodders rich in protein hardly to be ensilaged can more successively be conserved.

Considering both foreign and domestic results lucerne ensilation experiments with pulping were performed, subsequently with the silages obtained utilization and feeding investigations were also set up.

Material and Methods

Four silos of 12 m³ each, being at disposal in the Herceghalom Experimental Farm, were filled in summer 1958 with pulped lucerne from the first, second and third mowing, cut down in budding or in earlier stage and having a dry matter content of 22 to 27 per cent. Pulping was performed with a special machine of the type "Regina-8". The finely mashed material filled into the silos was compacted by slight treading. Dry matter losses were ascertained by using the so-called "tulle-sack" method, putting 1000 g of fodder into each sack; six of these sample-sacks were placed — in vertical distances of 1 meter — into the silos, filled with the fodder. Samples produced from the lucerne pulp of tulle-sacks served as samples of the material filled into the silos and the content of tulle-sacks taken out from the silos as samples of silages. From the silos two were covered by an air-tight top and two by PVC-sheets overspread with earth.

The nutritive value of fodders filled into and pulled out from the silos was calculated — with the exception of the material brought out from silo No. 5 — by the aid of the digestion coefficients obtained in the utilization experiments performed with pigs and sheep by MENTLER (1962, 1963) as well as by TANGL—SZENTMIHÁLYI (1961). For computing the nutritive value of the silage produced from silo Nr. 5 the digestion coefficients of the utilization experiment described in the present paper were applied.

With the material of the lucerne silage of silos No. 5, 6 and 10 a pig-feeding experiment lasting 109 days — from February 20 to June 9 1959 — had also been conducted. For this purpose from the porkings an experimental and a control group almost identical as to sex ratio had been formed both containing 20 individuals of nearly the same developmental stage and origin. The feeding of silage was begun with 0.3 kg, raising later the doses gradually according to the appetite of the animals. Individuals of the experimental group were fattened both on silage and concentrate, the control group on concentrate only. Fodder doses were assorted so that both groups were practically supplied with identical amounts of nutrients. From concentrate mixtures porkers obtained No. I until they reached 45 kg weight and subsequently No. II up to the completion of feeding.

<i>Mixture I</i>	
35 %	barley
30 %	maize
10 %	bran
15 %	pea
10 %	extracted soja bean

<i>Mixture II</i>	
35 %	barley
35 %	maize
10 %	bran
10 %	pea
10 %	extracted soja bean

Concentrate mixtures were also completed with fodder lime and salt.

The nutritive value of fodders used in the experiment was evidenced on the basis of data obtained by chemical analysis.

Due to the changing quality of silages the ration could be increased but slowly in the course of fattening. Silages of lower quality spoiled the appetite of animals, which consumed, therefore, the diurnal ration in a longer time.

Results

Beginning with February 1959 the well-closed silos were successively opened, and the silage samples of the tulle-sacks produced from the silos examined organoleptically for colour and smell. Data of this investigation and qualification, characterizing the content of the different silos, are summarized in Table 1. It reveals that all the prepared silages have maintained the original tissue structure, their colour changed from green to yellow, being green on the surface, but yellowish green and yellow in deeper layers. The material on the surface containing less water had a pleasant, slightly sour smell turning into a bad one in deeper layers indicating butyrous fermentation. The quality classes of examined silages ranged from II to IV.

Data on acid fractions established by the method of LEPPER and FLIEG are presented in Table 2.

The pH-value of raw silages was found to be 4.8 in the upper and 5.4 in lower layers. The quantity and proportion of acids resulting from fermentation showed favourable values only in the upper silage layer of silo No. 6, in silages of the other silos higher quantities of acetic and butyric acid were dominant.

From the aforesaid it turns out that neither the more perfect anaerob conditions provided by pulping nor the release of fermentable substances (cell-sap) are suitable means for satisfactory ensilation of lucerne.

Average data on the composition of nutrients and fermentation losses in silos No. 3, 5, 6 and 10 are demonstrated by Tables 3 to 6. Fermentation losses: in dry matter = 2.4 to 11.9 per cent, in organic substances = 3.3 to 13.5 per

Table 1
Organoleptic examination and qualification of silages

Silo No.	External properties	Colour	Smell	Quality
of silages produced from the silos				
3	Maintained unchanged its original tissue structure	light yellowish green	nasty butyrous	IV
5	Maintained unchanged its original tissue structure	the upmost 1 to 2 cm. thick layer of the surface high light green, below it yellowish green	the upper layer pleasant slightly sour	II
		the deeper layer olive-green with a slightly shade to brown	the deeper layers nasty butyrous	III
6	Maintained unchanged its original tissue structure	beside the original green layer some have a light yellow colour	on the surface slightly sour or somewhat butyrous	II
		yellow	the deeper layers stinky, highly butyrous	IV
10	The silo was only semi-filled, therefore the upper 5 to 6 cm. thick layer mouldy Below it normal, similar to the original material	olive-green	the upper layers are pleasantly bread-scented	II
			the deeper layers slightly butyrous	III

Table 2
Acid fractions in different horizons of the silos

No.	Kind	Silo horizon	pH	Acid fractions			Total acid content g%	In % of total acid content		
				lactic	acetic	butyric		lactic	acetic	butyric
3	Covered with plastic sheet and earth	upper	5.1	0.70	0.65	1.77	3.12	22.5	20.8	56.7
5	Covered with air-tight top	upper	4.8	0.59	0.63	0.30	1.52	38.8	41.5	19.7
5	Covered with air-tight top	middle	5.4	1.72	1.76	0.81	4.29	40.1	41.0	18.9
5	Covered with air-tight top	lower	5.4	1.71	1.75	0.81	4.27	40.1	41.0	18.9
6	Covered with plastic sheet and soil	upper	4.8	2.83	1.09	0.14	4.06	69.7	26.8	3.5
6	Covered with plastic sheet and soil	middle	5.4	1.54	1.59	2.21	5.34	28.8	29.8	41.4
6	Covered with plastic sheet and soil	lower	5.4	1.54	1.59	2.21	5.34	28.8	29.8	41.4
10	Covered with air-tight top	middle	4.8	1.35	1.79	Ø	3.14	43.0	57.0	—

cent, in crude protein 9.1 to 36.3 per cent, in pure protein it was but apparently 52.3 to 62.9 per cent, because in amide an increase of 193.8 to 813.3 per cent had appeared. Due to the presence of fermentation acids in raw fat a surplus of 20.6 to 32.0 per cent presented itself. Losses in raw fibres totalled 2.2 to 7.2, in N-free extractable substances 9.4 to 14.9 per cent, respectively.

Table 3
Nutrient composition and ensilation losses of lucerne
Silo No. 3

Composition of the material	Composition of the ensiled green lucerne		Composition of the silage prepared		Material			
	in the original material	in the abs. dry matter	in the original material	in the abs. dry matter	put into the silos	remained in the silage	Difference	
					per 100 kg fodder			
	%		%		kg		kg	%
Weight of the fodder	—	—	—	—	100.00	91.50	—8.50	—8.5
Dry matter	21.83	100.00	21.84	100.00	81.83	19.98	—1.85	—8.5
Organic substances ..	19.18	87.87	19.28	88.27	19.18	17.64	—1.54	—8.0
Crude protein	4.34	19.89	3.66	16.76	4.34	3.35	—0.99	—22.8
Pure protein	3.91	17.92	1.86	8.50	3.91	1.70	—2.21	—56.5
Amide	0.43	1.97	1.80	8.26	0.43	1.65	+1.22	+283.7
Raw fat	0.67	3.06	1.16	5.29	0.67	1.06	+0.39	—58.2
Raw fibre	5.48	25.13	5.86	26.83	5.48	5.36	—0.12	—2.2
Ash	2.65	12.13	2.56	11.73	2.65	2.34	—0.31	—11.7
N-free extractable substances	8.69	39.79	8.60	39.39	8.69	7.87	—0.82	—9.4
Digestible pure protein	2.74	12.54	0.78	3.57	2.74	0.71	—2.03	—74.1
Digestible crude protein	3.60	16.51	2.85	13.07	3.60	2.61	—0.99	—27.5
Starch value (calculated with pure protein)	9.08	41.61	6.69	30.65	9.08	6.12	—2.96	—32.6
Starch value (calculated with crude protein)	9.30	42.58	8.87	40.60	9.30	8.12	—1.18	—12.7

After all, in digestible pure and crude protein fermentation losses of 36.3 to 77.9 per cent, and 16.9 to 40.0 per cent respectively, were observed. Nutrient losses expressed in starch value reached 15.8 to 43.1 and 6.1 to 29.6 per cent, if calculated with pure and crude protein, respectively.

Investigation and calculation results disclosed that a bad trend in butyrous fermentation had unfavourably affected, above all, the changes of lucerne

proteins and the loss in starch value was not considerably greater than that evidenced by DÖRNER (1958) in parched lucerne silage of 36 per cent dry matter content.

The digestibility of nutrients of lucerne silage prepared in silo No. 5 was established in the usual manner by means of a utilization experiment

Table 4
Nutrient composition and ensilation losses of lucerne
Silo No. 5

Composition of the material	Composition of the ensiled green lucerne		Composition of the silage prepared		Material			
	in the original material	in the abs. dry matter	in the original material	in the abs. dry matter	put into the silos	remained in the silage	Difference	
					per 100 kg fodder			
	%	%	%	kg	kg	%		
Weight of the fodder	—	—	—	—	100.00	96.50	—3.50	—3.5
Dry matter	27.40	100.00	27.72	100.00	27.40	26.75	—0.65	—2.4
Organic substances . .	24.10	87.96	24.14	87.07	24.10	23.30	—0.80	—3.3
Crude protein	6.40	23.36	5.86	21.15	6.40	5.65	—0.75	—11.7
Pure protein	6.10	22.26	3.02	10.88	6.10	2.91	—3.19	—52.3
Amide	0.30	1.10	2.84	10.27	0.30	2.74	+2.44	+813.3
Raw fat	0.50	1.82	1.59	5.72	0.50	1.53	+1.03	+200.6
Raw fibre	7.40	27.01	8.06	29.06	7.40	7.78	+0.38	+5.1
Ash	3.30	12.04	3.58	12.93	3.30	3.45	+0.15	+4.5
N-free extractable substances	9.80	35.77	8.63	31.14	9.80	8.34	—1.46	—14.9
Digestible pure protein	3.66	13.36	2.41	8.70	3.66	2.33	—1.33	—36.3
Digestible crude protein	5.31	19.39	4.57	16.50	5.31	4.41	—0.90	—16.9
Starch value (calculated with pure protein)	8.08	29.50	7.05	25.43	8.08	6.80	—1.28	—15.8
Starch value (calculated with crude protein)	10.59	8.66	10.30	37.11	10.59	9.94	—0.65	—6.1

carried on for seven days with two barrow porklings of the white bacon pig type (weighing 90 kg each). The digestibility of nutrients in barley fed simultaneously with silage is shown by Table 7 and that of nutrients in lucerne silage by Table 8. The outstanding results as to the digestibility both of crude and pure protein may be attributed to the possibility of better utilization promoted by pulping. As against the relatively favourable utilization of fibre that of

N-free extractable substances seems unfavourable and can be explained by the digestive capacity of animals.

Applying the digestive coefficients mentioned earlier in the examined lucerne silages 19.98 to 26.75 per cent dry matter, 0.71 to 2.33 per cent digestible pure protein, 2.61 to 4.41 per cent digestible crude protein as well as 5.27 to

Table 5
Nutrient composition and ensilation losses of lucerne
Silo No. 6

Composition of the material	Composition of the ensiled green lucerne		Composition of the silage prepared		Material			
	in the original material	in the abs. dry matter	in the original material	in the abs. dry matter	put into the silos	remained in the silage	Difference	
					per 100 kg	fodder		
	%		%		kg		kg	%
Weight of the fodder	—	—	—	—	100.00	88.80	—11.20	—11.2
Dry matter	27.30	100.00	27.27	100.00	27.30	24.22	—3.08	—11.3
Organic substances ..	23.93	87.67	23.29	85.38	23.93	20.69	—3.24	—13.5
Crude protein	7.57	27.74	5.43	19.93	7.57	4.82	—2.75	—36.3
Pure protein	6.92	25.34	3.28	12.04	6.92	2.91	—4.01	—57.9
Amide	0.65	2.40	2.15	7.89	0.65	1.91	+1.26	+193.8
Raw fat	0.75	2.74	1.11	4.07	0.75	0.99	+0.24	+32.0
Raw fibre	5.52	20.21	6.64	24.36	5.52	5.90	+0.38	+ 6.9
Ash	3.37	12.33	3.98	14.62	3.37	3.53	+0.16	+ 4.7
<i>N</i> -free extractable substances	10.09	36.98	10.11	37.02	10.09	8.98	—1.11	—11.0
Digestible pure protein	4.84	17.74	1.38	5.06	4.84	1.23	—3.61	—74.6
Digestible crude protein	6.28	23.02	4.24	15.54	6.28	3.77	—2.51	—40.0
Starch value (calculated with pure protein)	11.43	41.90	7.32	26.86	11.43	6.50	—4.93	—43.1
Starch value (calculated with crude protein)	11.81	43.27	10.50	38.50	11.81	9.32	—3.49	—29.6

6.80 and 7.82 to 9.94 kg starch value (computed with pure and crude protein, respectively) were found.

The feeding plan of a silage feeding experiment conducted with fattening porklings of the white bacon pig type is presented in Table 9. A deviation from this plan took place from 50 kg weight onwards, because of the spoilage of appetite in both fattening groups and a decrease of rations was necessary.

Table 6
Nutrient composition and ensilation losses of lucerne
Silo No. 10

Composition of the material	Composition of the ensiled green lucerne		Composition of the silage prepared		Material			
	in the original material	in the abs. dry matter	in the original material	in the abs. dry matter	put into the silos	remained in the silage	Difference	
					per 100 kg fodder			
	%	%	kg	kg	%			
Weight of the fodder	—	—	—	—	100.00	88.00	—12.00	—12.0
Dry matter	25.50	100.00	25.52	100.00	25.50	22.46	—3.04	—11.9
Organic substances ..	19.40	76.08	19.49	76.35	19.40	17.16	—2.24	—11.5
Crude protein	5.80	22.74	4.85	19.02	5.80	4.27	—0.53	— 9.1
Pure protein	5.50	21.57	2.32	9.09	5.50	2.04	—3.46	—62.9
Amide	0.30	1.17	2.53	9.93	0.30	2.23	+1.93	+643.3
Raw fat	0.70	2.75	1.28	5.00	0.70	1.13	+0.43	+61.4
Raw fibre	5.80	22.74	6.11	23.94	5.80	5.38	—0.42	— 7.2
Ash	6.10	23.92	6.03	23.65	6.10	5.30	—0.80	—13.1
N-free extractable substances	7.10	27.85	7.25	28.39	7.10	6.38	—0.72	—10.1
Digestible pure protein	3.85	15.10	0.97	3.82	3.85	0.85	—3.00	—77.9
Digestible crude protein	4.81	18.87	3.79	14.84	4.81	3.34	—1.47	—30.6
Starch value (calculated with pure protein)	8.93	35.00	5.99	23.47	8.93	5.27	—3.66	—41.0
Starch value (calculated with crude protein)	9.37	36.74	8.89	34.83	9.37	7.82	—1.55	—16.5

Table 7
Utilization experiment with pigs
Examined fodder: barley

	Dry matter	Organic substances	Crude protein	Pure protein	Raw fat	Raw fibre	N-free extractable substances
<i>Group 1</i>							
Nutrients consumed (g)	1813.0	1757.4	262.6	220.2	55.0	97.6	1342.2
Nutrients defecated (g)	360.7	318.4	52.3	52.3	23.5	64.5	178.2
Nutrients utilized (g)	1452.3	1435.0	210.3	167.9	31.5	33.1	1164.0
Utilization coefficients (%)	80.10	82.88	80.08	76.25	52.27	33.91	86.72
<i>Group 2</i>							
Nutrients consumed (g)	1813.0	1757.4	262.6	220.2	55.0	97.6	1342.2
Nutrients defecated (g)	366.9	367.1	51.1	51.1	25.7	71.4	176.6
Nutrients utilized (g)	1446.1	1390.0	211.5	169.1	29.3	26.2	1165.6
Utilization coefficients (%)	79.76	79.11	80.54	76.79	53.27	26.84	86.87
Mean of utilization coefficients (%)	79.93	80.49	80.31	76.52	55.11	30.37	86.79

Table 8

Utilization experiment with pigs
Examined fodder: lucerne silage

	Dry matter	Organic substances	Crude protein	Pure protein	Raw fat	Raw fibre	N-free extractable substances
<i>Group 1</i>							
Nutrients consumed from barley (g)	906.5	878.7	131.3	110.1	27.5	48.8	671.1
Nutrients consumed from silage (g)	668.6	588.4	148.8	68.6	38.8	190.0	210.8
Total nutrients consumed (g)	1575.1	1467.1	280.1	178.9	66.3	238.8	881.9
Nutrients defecated (g)	566.3	478.2	45.9	43.6	27.7	163.5	241.0
Nutrients utilized from barley (g)	726.1	719.5	105.1	83.9	15.7	16.5	582.0
Nutrients utilized from silage (g)	282.7	269.4	129.1	51.4	22.9	58.8	58.9
Utilization coefficients (%) .	42.8	45.78	86.76	74.71	59.02	30.94	27.94
<i>Group 2</i>							
Nutrients consumed from barley (g)	906.7	878.7	131.3	110.1	27.5	48.8	671.1
Nutrients consumed from silage (g)	668.6	500.4	148.8	68.8	38.8	190.0	210.0
Total nutrients consumed (g)	1575.1	1467.1	280.1	178.9	66.3	238.8	865.0
Nutrients defecated (g)	413.4	353.9	31.1	29.5	20.4	113.3	189.1
Nutrients utilized from barley (g)	723.0	695.1	105.7	84.5	14.6	13.1	583.0
Nutrients utilized from silage (g)	385.7	371.1	131.3	58.9	28.3	97.2	92.9
Utilization coefficients (%) .	57.68	63.06	88.23	85.61	72.93	51.15	44.07
Mean of utilization coefficients (%).....	49.93	54.42	87.50	80.16	65.97	41.00	36.00

Accordingly, from lucerne silage a daily ration of 1.3 kg was fed per head and maize was not given at all.

Data of the silage feeding experiment lasting 109 days are summarized in Table 10. At the beginning and end of the experiment twenty porklings of identical average initial weight (27.58 kg) in both groups were examined. Weight standard deviations ($s = \pm 4.17, \pm 4.72$) showed a slight difference in favour of the experimental group. At the completion of silage feeding the average weight of the experimental group was 69.35 kg, that of the control group 70.25 kg. The former had a more favourable final weight standard deviations

Table 9
Feeding plan

Weight of porklings kg	Content		Composition		
	of the diurnal ration				
	Starch value	Digestible protein	Concentrate mixture	Maize	Lucerne silage
	g		kg	kg	kg

Experimental group

20—30	900	157	1.23	—	0.3
30—40	1170	203	1.56	—	0.7
40—50	1369	208	1.80	—	0.1
50—60	1650	243	2.10	0.15	1.5
60—70	1885	264	2.00	0.40	2.0

Control group

20—30	880	156	1.25	—	—
30—40	1145	203	1.63	—	—
40—50	1340	209	1.90	—	—
50—60	1650	241	2.00	0.30	—
60—70	1890	262	2.00	0.60	—

($s = \pm 7.67$) than the latter ($s = \pm 9.79$), but average diurnal weight increases were practically identical (383 g, 392 g).

Porkers in the experimental group needed less starch value (3232 g) for 1 kg weight increase than in the control group (3414 g), whereas the utilization of digestible protein reached nearly the same level (559 g, 563 g). Fodder utilization expressed in starch value percentage appeared also to be more favourable (30.94 per cent) in the experimental group as compared with that in the other (29.29 per cent). Feeding of silage saved 9.83 per cent of concentrate.

Conclusions

From the poor quantity of produced silages it can be concluded that the mashing of the lucerne into fine pieces — i.e. pulping — and, consequently, its higher-grade compression as well as the release of fermentable substances do not suffice, in themselves, for satisfactory ensilation of lucerne of normal water content. It may be assumed that — in spite of releasing the cellsap — the insufficient sugar content of ensiled lucerne did not accelerate the alteration

Table 10
Weight increase and fodder utilization

	Experimental	Control
	group	
Number of pigs		
at the beginning of the experiment	20	20
at the end of the experiment	20	20
Initial total weight (kg)	551.5	551.5
Average weight at the beginning of the experiment (kg) .	$\bar{x} = 27.58$	$\bar{x} = 27.58$
Standard deviation	$s = \pm 4.17$	$s = \pm 4.72$
Total weight at the end of the experiment (kg)	835.5	853.5
Average weight increase per pig (kg)	41.8	42.7
Difference in average weight increase (kg)	-0.9 (2.11%)	
Average diurnal weight increase (g)	383.0	392.0
Duration of the experiments (days)	109	
Number of feeding days	2180	2180
Concentrate consumed (kg)	3529	3995
Lucerne silage consumed (kg)	1958	—
Starch value consumed (kg)	2700	2914
Digestible protein consumed (kg)	467	483
Starch value utilized per 1 kg weight increase	3232	3414
Digestible protein utilized per 1 kg weight increase	559	563
Fodder realization (in starch value percentage)	30.94	29.29
Concentrate utilized per 1 kg weight increase (kg)	4.22	4.68
Weight difference of concentrates utilized per 1 kg weight increase (kg)	0.45	—
Weight difference percentage of concentrate utilized per 1 kg weight increase	9.83	—

of the pH-value to reach the optimum level rapidly. As a consequence, unfavourable microbiological processes became dominant, causing essential changes especially in proteins and considerable nutrient losses during fermentation.

The inferior quality of lower silage layers in the silos may perhaps be ascribed to the fact that the moisture (chiefly water) percolating downwards from upper layers of the pulped material and containing minimum quantities of fermentable substances, happened to accumulate in lower layers. The increasing water content diminished the dry matter proportion of the silage. Foreign and domestic investigations conducted so far have revealed that for papilionaceous silages the ideal pH-value can be provided by a certain relatively high (35 to 40 per cent) dry matter content, which exerts a stronger influence on quality than the advantage of lower silage layers compacted to a higher degree than the upper ones.

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DATA ON THE POSSIBILITIES OF CONTROLLING POTATO VIRUS

GENERAL SURVEY OF THE METHODS OF CONTROL AND THE VIRUS INFECTION OF EXPERIMENTAL POTATO VARIETIES

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In this paper on the practical methods of controlling potato viruses I shall survey the possibilities of protective, general and specific pathology, cultivation and biology of experimental potato varieties (*Somogyi Kifli*, *Gülbaba*, *Kisvárdai Rózsa*, *Mindenes*, *Somogyi Korai* and *Somogyi Sárga*).

Introduction

In order to control effectively potato virus it is extremely important to know the number of individual virus strains, their composition and the occurrence of complex forms in the general virus infections of potato plants. During the course of examinations carried out in Hungary it was noted that in recent years the occurrence of potato leaf roll virus (=PLRV) had been relatively higher than that of potato virus Y (=PVY) of the mosaic group (SZIRMAI 1954, SÁRVÁRI 1959, HORVÁTH 1960, 1962, 1963, HINFNER 1963).

With the appearance of the virulent, "veinal necrosis" (=Y^R) strain an essential change took place in the composition of the different virus diseases of Hungary (SZIRMAI 1958, HORVÁTH 1962, 1963, 1964). Our most recent examinations have indicated that the occurrence of mosaic-type viruses, especially that of the virulent Y^R strain of PVY and of certain still not very well known anomalous strains (=Y^{An})¹ (HEIN—BARTELS 1963, HORVÁTH 1966 b), requires not only special attention, but also necessitates significant changes in the methods of virus control.

A) General survey of the possible control methods

Since it has been proved that the various wild species contain genes for resistance (ROSS 1959, BAERECKE 1959) the future outlook of the struggle against certain viruses became much brighter. Nevertheless, concerning the PLRV in the field of improving resistance only relative resistance has been known up to the present time. Although we have advanced in controlling mosaic-type viruses by improving resistance through breeding, it is quite difficult to make any headway because of the great number of different strains and varieties of, for example, PVY.

Not mentioning a few positive results (KASSANIS 1950, THOMSON 1956, cf. WEIL 1957, MUKERJI—GUPTA 1963) the chemotherapeutical processes and all the other direct attempts

¹ Those PVY strains which exhibit mixed characteristics of the normal PVY strains (Y^N) and of the strains effecting the so-called necrotic browning of the veins (Y^R) are called anomalous. As to designate these anomalous strains I propose the symbol Y^{An}.

to control potato viruses are of experimental significance only (MATTHEWS—SMITH 1955, ZAKOPAL 1957, MELCHERS—BERGMANN 1959, ISSAACS 1961, RAMAKRISHNAN 1963).

Through the use of various chemicals it was possible to check the spread of certain viruses or more exactly to bring about their reversible inactivity, but not their elimination (LIMASSET et al. 1947). Biotherapeutical methods also play an important role in the therapy of plant virus diseases. In many instances the *in vitro* examination of the various antibiotics seems useful but because of the phytotoxic properties the *in vivo* therapeutical effects are insignificant (KLINKOWSKI 1954, BARTELS 1955).

Other attempts such as spraying infected plants with milk prepared from powdered milk, skimmed milk, or a water suspension of rice polish had no positive effects on PVY infection (SHANDS et al. 1962, 1964, SIMONS—MOSS 1963, SIMONS et al. 1963). These substances proved to be effective in case of other viruses such as tobacco mosaic virus and lettuce mosaic virus (HEIN 1961, 1962, 1964, MILINKÓ 1961a, b).

The use of systemic insecticides against virus-producing vectors are effective only against PLRV which is persistent (BAWDEN 1951, HILLE RIS LAMBERS et al. 1953, BROADBENT et al. 1958, BROADBENT 1960, WENZL 1961, KOLLMER et al. 1963, VAN DER WOLF 1964, POND 1964). Control by systemic insecticides can, at the most, hinder the spread of the so-called nonpersistent PVY which requires a shorter period of infection (BROADBENT et al. 1956, VAN DER WOLF 1964), but this cannot be considered an effective method (BIRECKI—GABRIEL 1962). In recent years several works have been published about the perspectives and results of the chemical control of virus vectors (OPITZ 1940, SCHMIDT 1948, SCHEIBE 1953, SALZMAN 1953, RÖNNEBECK 1954, HEINZE 1954, KLOSTERMEYER et al. 1956, BROADBENT et al. 1958, VAN DER WOLF 1964, POND 1964). From these works it may be concluded that it is possible to reduce the aphid populations but the virus infection can hardly be controlled. Thus the potential insecticides in themselves do not thoroughly control virus spread. Moreover it can be stated that the effects of systemic insecticides are very uncertain and are influenced by innumerable factors (such as the condition of the vectors, their abundance, weather, etc.). In addition, the factors that influence the living conditions of animal populations, — the ones that adversely affect biocenosis — also have to be taken into consideration. The effect of modern insecticides on the biocenosis of tillage is not yet known (STEINER et al. 1963).

All these objective difficulties result in seeking the direct and indirect control of potato viruses, or the possibilities of improving in agrotechnical methods, the quality of seed potatoes. Today certain methods (the German method, improved German, Dutch, and the summer planting method) have evolved which can be regarded more or less as prophylactic means of controlling potato viruses.

Purpose of the experiments

Since the production of seed potatoes is comparatively recent in Hungary (TEICHMANN 1959) and the practical methods of controlling potato viruses (the Dutch method) have been treated only in one comprehensive article so far (RÉTHY 1964), it is necessary to examine not only the problems of cultivation but the pathological angles of the question in light of the comparison of the mentioned agrotechnical methods.

B) Virus infection of experimental potato varieties

Material and methods

The experiments were made on 5 breeder-seed potato varieties (*Somogyi Kiflia*, *Somogyi Korai*^a, *Somogyi Sárga*^a, *Kisvárdai Rózsa*^b, *Mindenes*^c) and one variety selected from test fields (*Gülbaba*^d) at the Experimental Station of the Keszthely College of Agriculture in 1961.^{2,3}

² I am greatly indebted to S. BARSY^a, Head Researcher and Kossuth Prize winner, of Mariettapuszta, for supplying me with the varieties necessary for the experiment, and to K. AMBRÓZI^b, chief agronomist, Porva; F. PANKÁSZ^c, director, Lábod, and to F. ROSTA^d, chief agronomist, Homokszentgyörgy.

³ The area contains a brown woodland, sandy-clayey soil. The impermeable formation is 221 cm below the surface. The soil is slightly basic and somewhat unsaturated. It has a medium-poor humus content and a moderate nitrogen content. The annual precipitation of the area is 700 to 800 mm. The water supply is good. In March the snow cover is less than 1 cm thick. Danger from spring frosts is rare because from March onwards this is one of the areas least susceptible to frost. The prevailing wind is from the north. The mean summer temperature is between 20 and 21 °C.

The different varieties were planted in 100-hill units (in 4 replicates, 9 treatments) lying in a north-south direction following a planting of maize. They were planted on April 20th 8 cm deep in rows 70 cm apart and the distance of the hills was 35 cm. The soil of the field plots was given 100 quintals of stable fertilizer per cadastral acre⁴ in 1959, 100 kg of nitrogenous artificial fertilizer per cadastral acre in 1960 and 100 kg of nitrogenous artificial fertilizer per cadastral acre in 1961.

	10	0	0	0	0	0	0	0	0	0	0
	9	0	0	0	0	0	□	0	0	□	0
	8	0	X	0	X	0	0	0	0	0	0
	7	0	0	X	0	0	0	□	0	0	0
	6	0	X	0	X	0	□	0	0	0	0
	5	0	X	0	X	0	0	0	□	0	□
	4	0	0	X	0	0	□	0	0	0	0
	3	0	X	0	X	0	0	0	0	0	0
hill	↑	2	0	0	0	0	0	□	0	0	0
number		1	0	0	0	0	□	0	0	□	0
row number	→	1	2	3	4	5	6	7	8	9	10

Fig. 1 Order of potato plants in the 100-hill units tested by serological methods
X potato plants by the first serological examination. □ potato plants by the second serological examination

Results and their evaluation

1. Virus Studies

a) *Experiments using serological methods.* In order to identify the mosaic-type viruses (PVY, potato virus S (= PVS), potato virus X (= PVX)).⁵ The agglutination method was used.

This was applied identically with that described in my earlier publication (HORVÁTH 1962, 1963). Ten out of each 100-hill units were used as controls, i.e., a total of twenty plants. In the first serological test (between May 15th and 20th) I examined the 3rd, 5th, 6th and 8th hills of the second row, the 4th and 7th hills of the 3rd row, and the 3rd, 5th, 6th and 8th hills of the 4th row of both plots. The second serological examination was carried out between June 5th and 15th when the 1st, 4th, 6th and 9th hills of the 7th row, the 2nd and 7th hills of the 7th row, the 5th hill of the 8th row, the 1st and 9th hills of the 9th row and the 5th hill of the 10th row were examined in each plot (Fig. 1, Table 1).

b) *Examinations using the Igel—Lange method.* Using the Igel—Lange method I performed tests for PLRV just as I had described them in my earlier publication (HORVÁTH and RAINISS 1960, HORVÁTH 1962, 1963). For technical reasons the examinations included only those plants the identification of which was symptomatologically uncertain. Examination results include the symptomatological observations as well (Table 1).

In stating the condition of the different varieties I have taken into consideration the occurrence of the so-called complex forms, the number of healthy plants and the index of virus infection as I had proposed it in my earlier studies (HORVÁTH 1962, 1963, 1965) (Table 1).

c) *Examinations using test plant methods.* The identification of mosaic-type viruses (PVX, PVY, PVS) were done by test plant examinations in order to control the various serums as well as the various changes of symptoms (HORVÁTH 1962, 1964, HORVÁTH—SOLYMOSSY 1962). In the case of PLRV we used vector transmittance to prove the infection of plants identified symptomatologically or rather by the Igel—Lange method (HORVÁTH 1962, 1963).

⁴ Cadastral acre is a Hungarian acre equal to 1.42 acres.

⁵ I am greatly indebted to R. BARTELS (Biologische Bundesanstalt, Institut für Virusserologie, Braunschweig) and I. SÁRVÁRI (Keszthely College of Agriculture) for providing me with the serums used.

Table 1
Average virus infection of potato varieties
and the values of selection

Name of Variety	Average Results of Examination (in %)				No. Healthy Plants %	Complex Virus Forms %	Index of Virus Infect.	No. of Select Hills %
	PVX	PVY	PVS	PLRV				
<i>Somogyi Kifli</i>	15	33.5	32.5	25	33	20	106	37
<i>Gűlbaba</i>	22	12.5	69.5	39	9	43	143	51
<i>Kisvárdai Rózsa</i>	13.5	9	39	57	12	32	118.5	77
<i>Mindenes</i>	8	5	59	23	32	22	95	35
<i>Somogyi Korai</i>	11.5	13.5	48.5	14	30	19	87.5	23
<i>Somogyi Sárga</i>	10	11	35.5	31	35	17	87.5	45

d) *Symptomatological examinations.* During the growing period every plot had been symptomatologically examined on 4 occasions in order to remove with the aid of the discussed methods those plants suspected of being infected. In every case identification was immediately followed by selection (Table 1).

e) *Examinations* using the „Tuber-index” method. In taking samples we proceeded in such a way that there should be a positive correlation between the number of hills selected and the number of sampling hills. The general goal was the examination of 200 tubers of every variety. This was achieved by dividing in 2 the number of plants remaining after selection and dividing the resultant by the number of sample tubers per variety. This ration indicated the order in which tubers should be removed for sampling.

The tuber-index method was carried out on October 13 in the way described in my earlier publications (HORVÁTH 1959, 1961, 1962). Virus examinations using serological and symptomatological examinations occurred between December 11 and 16 (Table 2). The values thereby received indicate the actual health of the experimental potato varieties.

Table 2
Correlation of the results of summer field experiments
and the autumn examination by tuber-index method
(Virus examination)

Variety	Occurrence of Viruses in %				Occur. of Healthy Plants %	Occur. of Complex Virus Forms %	Index of Virus Infection
	PVX	PVY	PVS	PLRV			
<i>Somogyi Kifli</i>	15/2 ^a	33.5/3	32.5/33	25/2	33/71	20/5	106/40
<i>Gűlbaba</i>	22/16	12.5/4	69.5/46	39/9	9/46	43/13	143/75
<i>Kisvárdai Rózsa</i> ..	13.5/10	9/7	39/20	57/10	12/69	32/11	118.5/47
<i>Mindenes</i>	8/2	5/—	59/40	23/1	32/58	29/1	95/43
<i>Somogyi Korai</i> ...	11.5/2	13.5/2	48.5/38	14/4	30/60	19/2	87.5/46
<i>Somogyi Sárga</i>	10/4	11/2	35.5/26	31/3	35/74	17/6	87.5/35

a) The numerator expresses the results of the field experiments while the denominator those of the autumn examination of tuber-index

Here the connections between the results of summer identification and autumn examinations of tuber-index should be mentioned (Table 2). The differences between the results of the two examinations can be attributed partly to the removal of all the infected hills during the summer examinations and partly to the careful selection.

2. Examinations of yield

These studies succeeded in proving how the average yield and standard size distribution of the tubers of the different varieties used (MSz/6377) 1960/per cadastral acre were brought about.

a) *Results of experiments on oblong varieties.* After harvesting every single tuber of the oblong varieties (*Gülbaba, Somogyi Kifli, Kisvárdai Rózsa*) was measured with a grader and then grouped according to standard sizes. Afterwards, the number of tubers belonging to every category was separately tallied and the resultant figures converted into percentages, with the total yield considered as 100% (Table 3).

b) *Results of experiments with short, round varieties.* The short, round varieties (*Mindenés, Somogyi Korai, Somogyi Sárga*) were classed the same as the oblong ones with the exception that the grader was changed in order to suit the standard (Table 3).

3. Content analysis of potato varieties

In this group of studies the water, dry matter, starch, vitamin C and sugar contents of the potato varieties were measured.⁶

After the drying of the foliage of the individual varieties and the full ripening of the tubers samples were selected in a regular way.

a) The water content was determined by drying 100 grams of finely grated potato pulp until the weight stability was reached (Table 4).

b) In order to determine the dry-matter content (Table 4) the specific gravity of the individual samples was first determined and on this basis the weight of 5 kilograms of tubers of the same specific gravity as measured in water was calculated. From the figures thus gained we checked the percentage of dry matter content from a table.⁷

c) Vitamin C content was done by using a 2.6 dichlorophenol-indophenol titration (Table 4).

d) Fehling's method was used to determine the sugar content.

4. Examination of aphids as virus vectors⁸

In 1960 the Research Institute for Plant Protection started a regular study of the aphids found on potato plants, which work was planned to extend over several planting seasons (SZALAY—MARZSÓ 1961, 1962, BORUS et al. 1965). The first winged aphids appeared on May 14, 1961 and until the middle of June their number rose gradually then rapidly. The peak of aphid infestation occurred at the end of June when the aphids infested 92% of the plants. Until the middle of July the number of aphids decreased rapidly, then gradually until the middle of August. From this time onwards the potatoes were aphid-free. Up to the middle of May the entire aphid population was composed of winged insects. Nymphs appeared between

⁶ I am greatly indebted to the late J. PALOTÁS, head, and L. KEGL, engineer (OMMI, Dept. of Soil Science, Budapest) and also to I. HALMÁGYI, engineer (Keszthely College of Agriculture) for helping to determine the water and dry matter content of the specimens.

⁷ The NISSEN procedure for determining the dry matter content of potatoes based on the linear relation of dry content to the weight of potatoes measured in water, is already outmoded because it has been proved that the results are inconsistent. A new process (SAINI 1964) which determines the specific gravity of dry matter in oil has proved to be much more dependable. The values gained are always consistent, although somewhat higher than those of NISSEN.

⁸ As part of my experimental program (the results of the first year are being published in this present study) SZALAY—MARZSÓ has examined the aphids as virus vectors of potatoes. Here I should like to express my gratitude to him for allowing me to use his data, which may also be found in a separate article together with a detailed description of the methodology used (SZALAY—MARZSÓ 1961, 1962, BORUS et al. 1965).

Table 3

Yields of the different varieties and the grading of tubers according to standard sizes

(O = oblong varieties, R = round, short varieties)

Variety and Date of Harvesting, 1961	Average Yield/Hill in decagrams	Grade in mm.	Grade %	Yield quintals/cadastral acre
<i>Somogyi Kifli</i> (O) 23rd August	0.30	0-34	17.25	70.46
		35-79	58.67	
		80-100	11.56	
		101-120	10.70	
		above 121	1.82	
<i>Gülbaba</i> (O) 23rd August	0.25	0-34	19.42	58.72
		35-79	62.79	
		80-100	12.10	
		101-120	3.50	
		above 121	2.19	
<i>Kisvárdai Rózsa</i> (O) 25th September	0.80	0-34	28.7	187.90
		35-79	58.9	
		80-100	9.8	
		101-120	2.2	
		above 121	0.4	
<i>Mindenes</i> (R) 25th September	0.88	0-39	41.06	206.88
		40-60	51.01	
		61-80	7.66	
		above 81	0.27	
<i>Somogyi Korai</i> (R) 23rd August	0.60	0-39	43.26	140.92
		40-60	43.44	
		61-80	12.72	
		above 81	0.58	
<i>Somogyi Sárga</i> (R) 25th September	0.83	0-39	29.5	194.95
		40-60	55.8	
		61-80	14.1	
		above 81	0.6	

June 10th and 20th and the winged insects again comprised a significant proportion (62%) of the developed aphids. The population was composed of *Myzus persicae* Sulz. (20%), *Aphis nasturtii* Kalt. (35%), *Aphis gossypii* Glov. (39%), *Aulacorthum solani* Kalt. (6%) (cit. SZALAY—MARZSÓ 1962).

5. Storing the potatoes

After being harvested classed and selected the different potato varieties were stored in forcing boxes and cellars dug in the earth. As it is known, temperature is of basic importance in storage, for temperatures above 10°C contribute to the rotting of the tubers. Optimum

Table 4
Results of the content analysis of potato varieties

Variety	Date of Examination 1961	Results of Examination				
		Water Content %	Dry Matter Content %	Starch Content	Vitamin C Content	Sugar Content (Invert Sugar)
<i>Somogyi Kifli</i>	24th August	74	26	18.551	2.4	0.66
<i>Gülbaba</i>	24th August	78	22	13.450	2.3	0.81
<i>Kisvárdai Rózsa</i>	25th September	73.2	26.8	22.190	5	0.59
<i>Mindenes</i>	25th September	74	26	23.474	4.2	0.74
<i>Somogyi Korai</i>	24th August	75.4	24.6	17.813	3.6	0.59
<i>Somogyi Sárga</i>	25th September	78.4	21.6	22.221	5	0.73

storage temperature is between 0 and +5° C (GALL 1961). During my own experiments the highest and lowest temperature values measured from September to June were favourable for storage (in December: 5—5.7° C; January: 4—4.7° C; February: 3.7—4.1° C; and in March 3.2—4° C). The highest mean temperature values of June did not exceed 12° C. Consequently the potato varieties could be stored until the summer planting period without loss. The temperature and moisture of the storage cellar must be suitably controlled e.g. by ventilation (FISCHNICH—THIELEBEIN 1956), for, in case of those being too high may contribute to the development of decay causing fungi and bacteria (HERMAN—DONATH 1957, GROSKREUTZ 1954). Above the storage cellar I set up a manually controlled air vent and thus succeeded in keeping both temperature and moisture at the desired level. FISCHNICH (1955) proved in his experiments that light was very important for stored potatoes. It is especially useful for the seed potatoes if the proper illumination of the storage place is assured as, in this case, the tubers grow strong sprouts which do not break off so easily. There was no artificial illumination in the storage cellars, but the forcing of the various varieties was done in a forcing house especially outfitted for my particular needs. (The results of this will be published later.)

*

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FERTILIZATION CONDITIONS IN BERRY PRODUCING FRUIT VARIETIES

II. STRAWBERRY — GOOSEBERRY

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Strawberry. The 24 strawberry varieties examined are self-fertilizing. In open pollination the result of fruit setting has been 20 to 50 per cent higher proving pollinating varieties are necessary. In the varieties examined also a parthenocarpic trend can be demonstrated.

Gooseberry. The self-fertilizing ability of the 10 gooseberry varieties examined is very variable. Open pollination has resulted in a 30-50 per cent higher fertilization. In the varieties examined also a parthenocarpic trend can be demonstrated.

Introduction

The necessity of examination for the fertilization conditions in berry producing fruit varieties has been thoroughly treated by SELJAHUDIN—BRÓZIK (1965).

Material and Method

Methodical literature concerning the biology of flowering in berry producing fruit varieties can be found in SELJAHUDIN—BRÓZIK's paper (SELJAHUDIN—BRÓZIK, 1965) which includes also a most detailed analysis of examination methods applied here.

Results and Discussion

Strawberry

Research work on fertilization conducted in strawberry for six years generally elucidated conditions of free self- and cross fertilization of the varieties.

According to our experience the flowers of the first and second order of the strawberry plant in the case of proper climate, nutritive power of the soil and shape of the plant are fertilizing very readily, while the flowers of the third and fourth order differently, according to the variety.

Data obtained show that in the case of 24 varieties open fertilization ranged from 50 to 100 per cent. This good result apparently supports the opinion of RUDLOFF—SCHANDERL (1950) stating that the fertilization conditions of berries are less discussed because in these low yields seldom occur. Varieties studied between 1958 and 1962: *Brigadéros, Campione, Captain Cook, Eszterházi*

Table 1

Fertilizing ability of strawberry varieties among each other

Serial number	When involved as father (pollinator)		When involved as mother	
	<i>Eszterházi korai</i>	<i>Madame Moutot</i>	<i>Eszterházi korai</i>	<i>Madame Moutot</i>
1. <i>Afrika</i>	very good	medium	good	good
2. <i>Eszterházi korai</i>	—	medium	good	good
3. <i>Mme. Moutot</i>	medium	—	good	—
4. <i>Mieze Schindler</i>	very good	medium	no pollen (female flowers)	no pollen (female flowers)
5. <i>Poznaja iz Zagorja</i>	poor	good	medium	medium good
6. <i>Regina Früheste</i>	good	very good	medium poor	medium
7. <i>Senga Sengana</i>	very good	very good	medium	good
8. <i>Souvenir de Charles Machiroux</i>	good	poor	good	very good
9. <i>Surprise des Halles</i>	very good	good	medium	very good
10. <i>Brigadéros</i>	medium	—	medium	good
11. <i>Laxton's Royal Sovereign</i>		—	very poor	—

export, *Eszterházi korai*, *Hansa I.*, *Huxley*, *Laxton's Royal*, *Laxton's Royal S.*, *Madame Moutot* (Budatétény), *Mathilde*, *Oberschlesien*, *Páduai Szent Antal*, *Poznaja iz Zagorja*, *Rügen Schwabenland*, *Sertilita*, *Wonderful* (Fig. 5).



Fig. 1. Radically castrated strawberry flowers

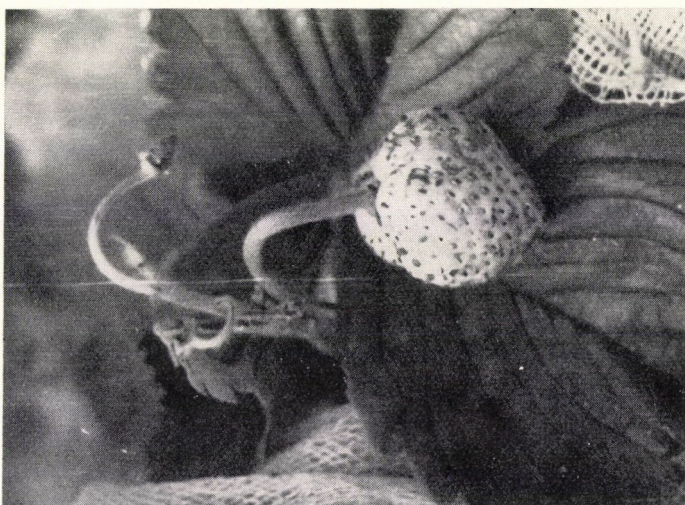


Fig. 2. Parthenocarpic fruits of the strawberry variety *Óriás Elefánt*



Fig. 3. Developed parthenocarpic fruits of the gooseberry variety *Grüne Hansa*

In 1963—64 examinations were extended among others to the following important varieties: *Afrika*, *Mieze Schindler*, *Regina Früheste*, *Senga Sengana*, *Souvenir de Charles Machiroux*, *Surprise des Halles*. (Fig. 6).

In the following the 4 and 2 year experiments will be dealt with together.

From the strawberry varieties in the last analysis the varieties *Senga Sengana*, *Surprise des Halles*, *Captain Cook*, *Eszterházi korai*, *Laxton's R. Sovereign*, *Madame Moutot* (Budatétény), *Poznaja iz Zagorja* and *Wonderful*

distinguished themselves with *open fertilization* results above 60 per cent. Poorer results were obtained from the varieties *Campione*, *Mathilde*, *Rügen* and *Sertilita* in which the 4 year mean of the open fertilization remained below 50 per cent.

Analysing the results year by year it appears that they may change to some degree and thus can be regarded as fluctuating, e.g. the varieties *Schwabenland*, *Huxley* or *Mathilde*, the latter exhibiting greater differences. This can

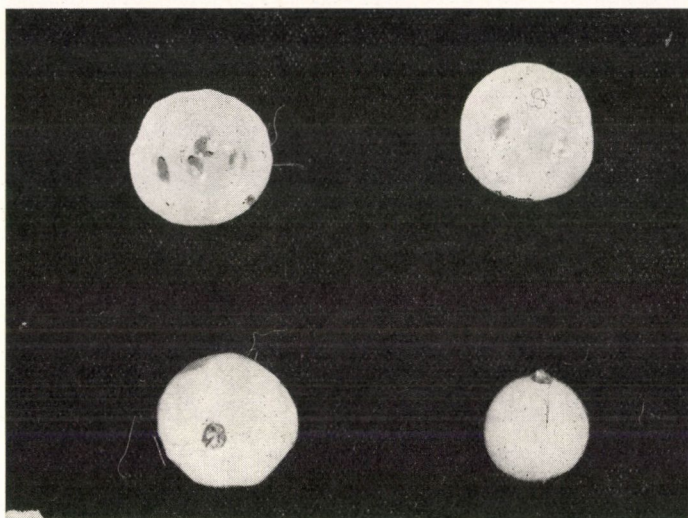


Fig. 4. Parthenocarpic fruits of *Grüne Hansa* with small amount of developed seeds

be ascribed first of all to factors influencing the experiments, such as the weather, manpower etc. This phenomenon can be observed also in the other (B—B₁—C) tests, while in some varieties e.g. *Surprise des Halles*, *Senga Sengana*, *Regina Früheste*, *Afrika*, *Huxley*, fertilization is uniformly high.

The results of the selfing tests (B—B₁—C) unequivocally verify that the strawberry varieties are self-fertilizing. The degree of selfing, however, is different, depending on the variety. The same result was obtained by BULLMANN (1961) and PORPÁČZY (1962).

According to test "B" conducted in 24 varieties the percentage of selfing ranges, during 6 years, between 9 and 100 per cent. Where the flowers are hermaphrodite and the stamina well developed (*Senga Sengana*, *Regina Früheste*, *Surprise des Halles*, *Afrika*, *Brigadéros*, *Huxley*, *Rügen*) the per cent of self fertilization is the highest, ranging between 70 and 100 per cent, while in varieties where the stamina are rudimentary (*Laxton's Royal Sovereign*, *Wonderful*, *Mieze Schindler*) self-fertilization is very poor, about 10 per cent. RUDLOFF—SCHANDERL (1950) came in their studies to similar conclusions, stating

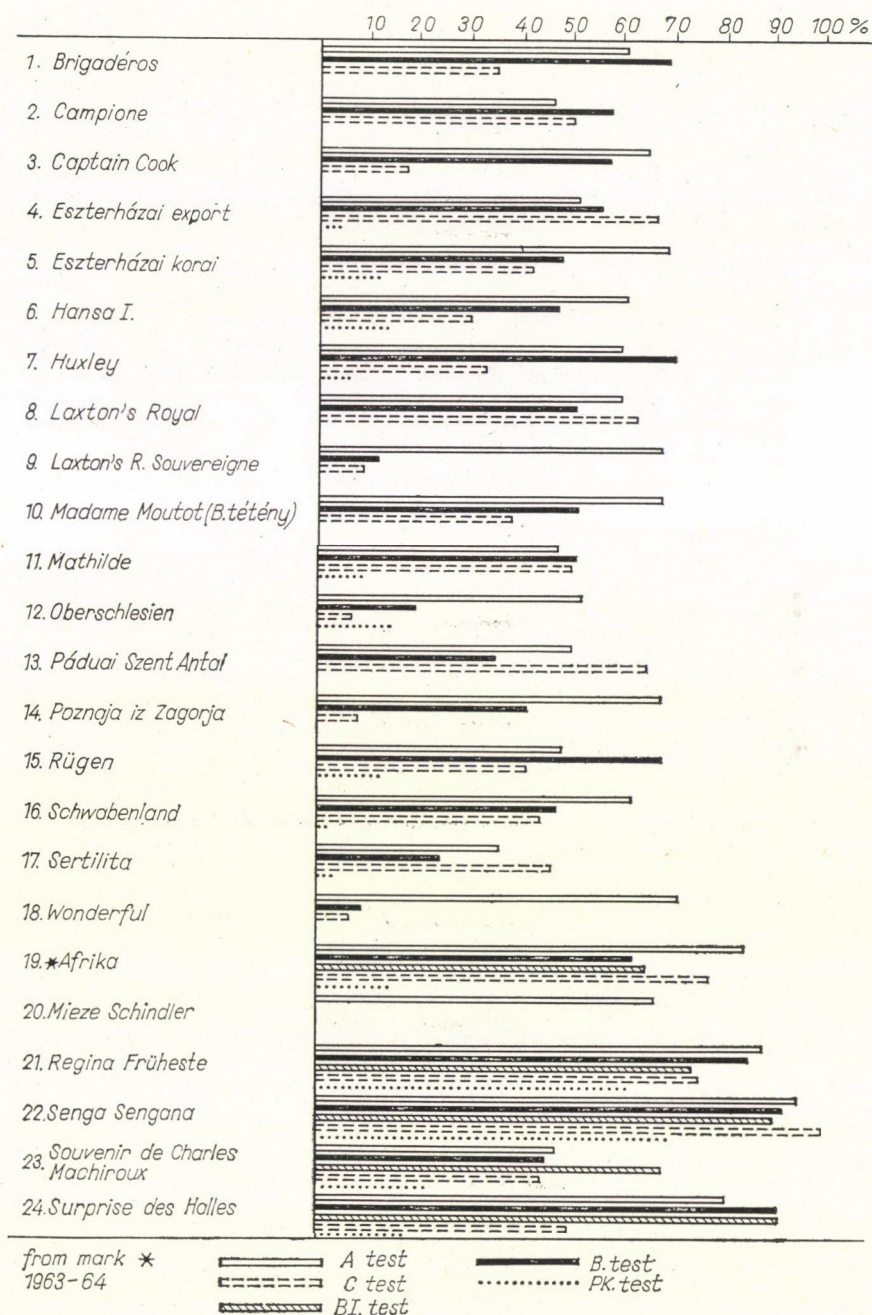


Fig. 5. 4 year mean results of the A, B, B₁, C, Pk tests of strawberry varieties (1958—1962)

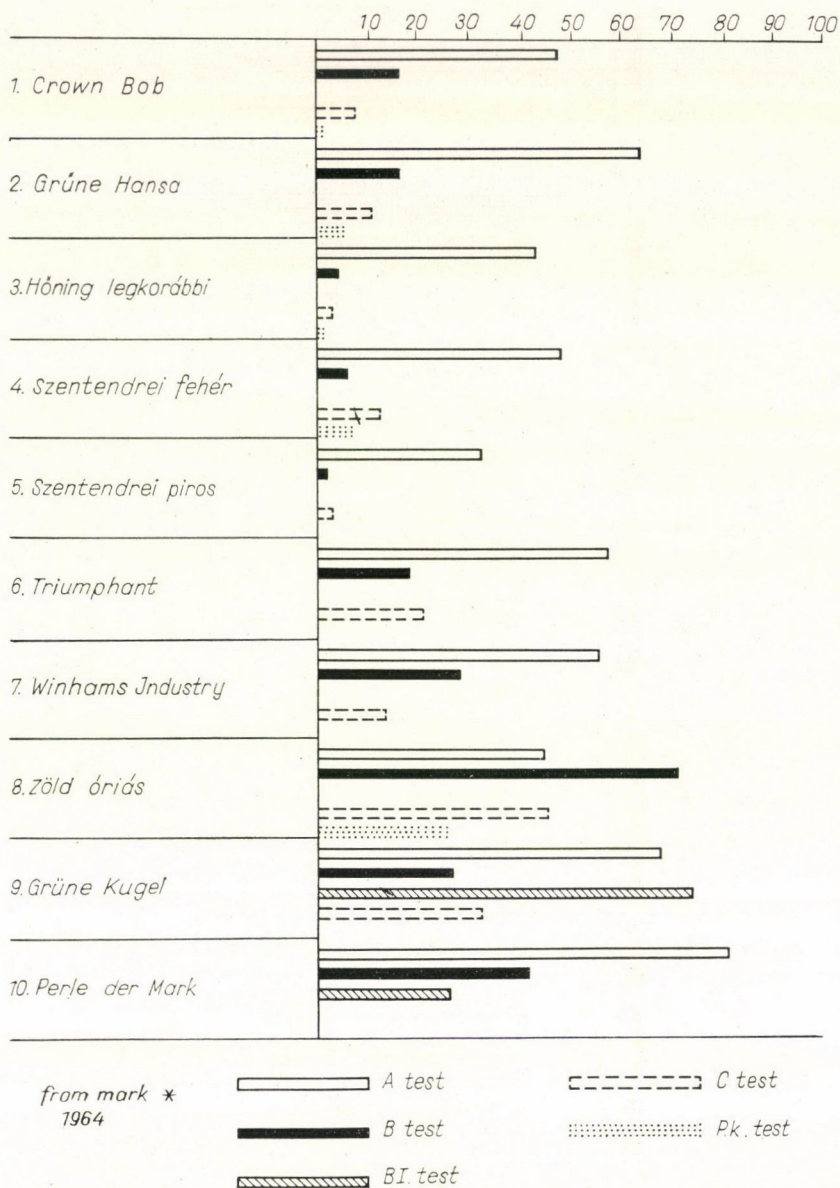


Fig. 6. 4 year mean results of fertilization tests in gooseberry varieties (1958–1961) Érd-Elvira

that their data for the variety *Oberschlesien* are verified by the English findings. The pollen of this variety as a consequence of its low germination is not suited either to self pollination or to the fertilization of other varieties. (According to these authors KRONENBERG (1958), BAUER (1960) and HAROLD (1940) as well as BULLMANN (1961) and VALLEAU (1918) arrived at the same conclusions.

The B_1 selfing examinations started additionally in 1963 (isolation — fertilization of the stigmata of the opened flowers with the own pollen) show that there is no essential difference between the results of the two self-fertilization experiments. The deviation of 1—10 per cent was either to the benefit of one or the other examination. Thus, in our opinion the B_1 test is omissible in the self-fertilization investigations.

The "C" tests were undertaken as a control of the selfing experiments, the results supporting those of examinations "B" and " B_1 " hence they undoubtedly prove the degree of self-fertilization.

Examinations of fertilization among varieties — test D — had been extended from 1958 to 1962 to several varieties widespread in cultivation, among others *Eszterházi korai* and *Madame moutot* and subsequently from 1963 nine more varieties being spread just now were included in the study (Table 1).

The examinations have proved that the fertilizingability of varieties between each other is variable. There are varieties which consistently fertilize each other: a. very readily b. well c. medium or poorly. Self sterility or mutual sterility has not been found among varieties. The same was established by DARROW (1927) and PORPÁČY (1962).

Fertilizing ability of varieties among each other has been evaluated according to the following scale:

very poor fertilization	1— 20 per cent
poor fertilization	20— 40 per cent
medium fertilization	40— 60 per cent
good fertilization	60— 80 per cent
very good fertilization	80—100 per cent

The mean data of the fertilization per cents are, as reflected by the evaluation range for each combination the following:

For the variety *Eszterházi korai* the following pollinating varieties have proved to be good: *Afrika*, *Madame Moutot*, *Souvenir de Charles Machiroux*.

For the variety *Madame Moutot*: *Afrika*, *Eszterházi korai*, *Senga Sengana*, *Surprise des Halles*, *Souvenir de Charles Machiroux*.

Variety *Eszterházi korai* is readily pollinating the following varieties: — it is very good for *Afrika*, *Mieze Schindler*, *Senga Sengana*, *Surprise des Halles*, — good for *Regina Früheste*, *Souvenir de Charles Machiroux*.

Variety *Madame Moutot* fertilizes very well the following varieties: *Regina Früheste*, *Senga Sengana*, — well the following ones: *Surprise des Halles*, *Poznaja iz Zagorja*.

The results of the "D" test cannot be considered definite as yet because in the years to come the best reciproque combinations must be found out for each variety that is being spread now must be found out.

Our experiments extended also to the parthenocarpic phenomena in strawberry ("Pk" tests), since it appeared that some varieties when castrated produced fruit without pollination. We did not find any such reference in literature concerning the strawberry. Related to this RUDLOFF—SCHANDERL (1950) only stated that from the flowers isolated for this purpose they had obtained degenerate, unpalatable green fruits.

We have intended to clarify satisfactorily whether there are strawberry varieties with such inclination. This property, of course, would promote safety of yield for the variety because if any obstacle to the pollination should arise, a certain amount of yield could be reckoned with at any rate.

From the varieties examined the following have exhibited parthenocarpic inclination: *Mathilde*, *Eszterházi export*, *Hansa*, *Luigi Gauthier*, *Senga Sengana*, *Afrika*, (for 2 years); *Sertilita*, *Huxley*, *Rügen*, *Abbondanza*, *Eszterházi korai*, *Oberschlesien*, *Schwabenland*, *Madame Moutot*, *Regina*, *Souvenir de Charles Machiroux* (for 1 year).

Thus according to experiments, the inclination of the varieties in the above direction is variable, but the fact that this inclination could not be found at all in some varieties while it has appeared as a recurrent phenomenon in others, proves its occurrence. In certain varieties it appears even with such high values (e.g. *Senga Sengana* a mean of 40—60 per cent) that it seems worth while drawing attention to the phenomenon and dealing with the problem.

As shown by the photo in Fig. 2 the aggregate fruit is generally of normal development but the majority of the fruits are empty. This is in contradiction to the statements of KRONENBERG (1959) and RUDLOFF—SCHANDERL (1950) according to whom when the flowers are fertilized deficiently the aggregate fruits will be of a deformed, degenerated shape. According to our studies this is only true when the variety is not inclined to parthenocarpy.

This phenomenon, owing to its importance, deserves further thorough investigation e.g. cytogenetical studies, since the developed aggregate fruits point to apomixis.

Gooseberry

Self-fertilization studies on gooseberry were conducted from 1958 to 1961 with the following varieties: *Grown Bob*, *Grüne Hansa*, *Höning legkorábbi* (earliest), *Szentendrei fehér* (white), *Szentendrei piros* (red), *Triumphant*, *Win-*

hams Industry, Zöld óriás (Green Giant) and in 1964 examinations were extended to two further varieties — *Perle der Mark* und *Grüne Kugel*.

The mean data of the 10 varieties evaluated have revealed very important differences.

First of all it has been demonstrated that in the degrees the gooseberry varieties of self-fertilization dispose of the widest range.

While in the "A" tests, though depending on the year, in open fertilization the average results vary between 35 and 80 per cent (the annual deviations between 6 and 95.5 per cent) this excellent result is found in the "B" and "C" tests only at the variety *Zöld óriás* (Green Giant).

On the strength of selfing the varietal ranking offers in itself. Accordingly, the varieties *Höning legkorábbi*, *Szentendrei fehér* and *Szentendrei piros* with a self fertilization of 1—5 per cent are practically self sterile while *Crown Bob*, *Grüne Hansa* and *Triumphant* with 5—20 per cent can be regarded as poorly, *Winhams Industry*, *Grüne Kugel* with 20—35 per cent as medium, *Perle der Mark* with 35—50 per cent as well and *Zöld óriás* with results of above 70 per cent as very well self-fertilizing varieties.

BULLMANN (1961) also states that the gooseberry varieties are largely self-fertilizing, but according to him there are also poorly self-fertilizing and practically self sterile varieties. According to this author cross fertilization has, however, a great influence on the degree of fertilization, on size and weight of the fruits. The same facts were established in his opinion by SCHANDEL (1954, 1959) and LOGINYCHEVA (1950, 1958). The investigations of TÓTH (1959) have agreed with us in finding the variety *Zöld óriás* to be self-fertilizing while *Szentendrei fehér* self sterile.

As to gooseberry TÓTH (1959) also establishes that seed setting of castrated flowers left alone lags considerably behind that of non castrated and non isolated flowers. RUDLOFF—SCHANDERL (1950) in their experiments out of 40 gooseberry varieties examined found only nine to be self-fertile. As a result of their study these authors state the gooseberry varieties behave very differently as to biology of flowering. According to their experience larger yields can be obtained with cross pollination. BULLMANN (1961) further states that in respect of fertilization conditions the gooseberry varieties behave differently; among them there are largely self-fertilizing ones. Referring to an other author he mentions that by cross pollination the weight of the fruit can be substantially increased. He also found in some varieties degenerated and physiologically female flowers the anthers of which had not produced pollen. LOGINYCHEVA (1950, 1958) for the gooseberry varieties examined establishes that the degree of self-fertilization is variable according to varieties. In some varieties cross pollination has not resulted in better seed setting, so these, according to the author, can be planted also by themselves. To obtain higher seed setting she still considers mixed planting as important.

In 1964 as to the newly included two varieties for *Perle der Mark* the "B" test gave a higher fertilization (41—97 per cent) than the "B₁" test (26—58 per cent) while for *Grüne Kugel* the opposite was found ("B" — 26.53 per cent, "B₁" — 74.34 per cent.)

"C" tests conducted with gooseberry have demonstrated the injurious effect of castration more definitely than in any other berry, to which points the 2 to 25 per cent fall of the mean data, taking the "B" tests as a basis.

In our opinion partly the same fact is pointed out also by the results obtained for the crosses of the varieties among each other. The "A" tests, however, undoubtedly prove the extraordinary importance of the foreign pollen because seed setting is 30—50 per cent higher than in the "B" tests. The "D" tests do not show this so convincingly.

According to the "D" tests the question of the combinations among varieties remains partly open even after the examinations, since the five varieties studied cannot answer all questions.

Among the combinations the following have given the best results:

<i>Zöld óriás</i>	× <i>Höning legkorábbi</i>
	× <i>Szentendrei fehér</i>
<i>Szentendrei fehér</i>	× <i>Zöld óriás</i>
<i>Höning legkorábbi</i>	× <i>Zöld óriás</i>
<i>Perle der Mark</i>	× <i>Zöld óriás</i>
<i>Grüne Kugel</i>	× <i>Zöld óriás</i>
	× <i>Szentendrei fehér</i>

Though the "Pk" tests show that from the ten varieties examined five (*Crown Bob*, *Grüne Hansa*, *Höning legkorábbi*, *Szentendrei fehér*, *Zöld óriás*) have been found to incline to parthenocarpy, yet this, occurred, in the majority of cases, but in one year. Only the result obtained with the variety *Zöld óriás* in three consecutive years is convincing. In a part of the parthenocarpic fruits a slight number of developed seeds has been found which points to apomixis (Fig. 3—4).

The parthenocarpic inclination in gooseberry has been observed by many authors, so e.g. TÓTH (1959) demonstrates that for fruit setting without fertilization in gooseberry varietal inclination is necessary, but in the fact that this inclination appears in one year more strongly than in the other he finds the role of the weather to be an important factor. He refers as an example to the variable inclination of the variety *Zöld óriás*, in contrast to our own examinations in which this variety consistently exhibited the parthenocarpic habit while supporting the apomixal trend in *Zöld óriás* when stating that the fruits thus obtained were full of seeds. PORPÁCZY (1962) also established the parthenocarpic inclination of gooseberry.

In foreign literature RUDLOFF—SCHANDERL (1950) discuss the parthenocarpic trend with gooseberry and consider several varieties as highly sus-

ceptible, such as *Grüne Flaschenbeere* and *Rote Triumphbeere*. These authors refer to EWERT (1906) who as early as before 1906 discovered this trend in some gooseberry varieties.

Conclusions

Strawberry

The 24 strawberry varieties examined are self-fertilizing. Poorly self-fertilizing are the varieties with female flowers *Laxton's Royal Sovereign*, *Wonderful*, *Mieze Schindler*. Very readily self-fertilizing (between 70 and 100 per cent) are *Senga Sengana*, *Regina Früheste*, *Surprise des Halles*, *Afrika*, *Huxley*.

In open pollination the result of fruit setting has been 20 to 50 per cent higher proving pollinating varieties are necessary.

In our tests the following combinations have proved to be good.

For *Eszterházi korai*: *Madame Moutot*, *Souvenir de Charles Machiroux*.

For *Madame Moutot*: *Afrika*, *Eszterházi korai*, *Senga Sengana*, *Surprise des Halles*, *Souvenir de Charles Machiroux*.

Eszterházi korai is a good source of pollen for the varieties *Afrika*, *Mieze Schindler*, *Senga Sengana*, *Surprise des Halles*, *Regina Früheste*, *Souvenir de Charles Machiroux*.

Madame Moutot is a good pollen source for the varieties *Regina Früheste*, *Senga Sengana*, *Surprise des Halles*, *Poznaja iz Zagorja*.

The following varieties excelled with a parthenocarpic trend: *Senga Sengana*, *Afrika*, *Eszterházi export*, *Hansa*, in which this trend appeared as a constant varietal feature. In other varieties this inclination is completely missing or only appears in some years to a low percentage.

Gooseberry

The self-fertilizing ability of the 10 gooseberry varieties examined is very variable.

Practically self sterile varieties with 1—5 per cent fruit setting are *Höning legkorábbi*, *Szentendrei fehér* and *Szentendrei piros*.

Poorly self-fertilizing (5—20 per cent) *Grown Bob*, *Grüne Hansa* and *Triumphant*.

Medium selfing (20—35 per cent): *Winhams Industry* and *Grüne Kugel*.

Readily selfing (35—50 per cent): *Perle der Mark*.

Very well self-fertilizing (above 50 per cent): *Zöld óriás*.

Open pollination has resulted in a 30—50 per cent higher fertilization.

In the combination among varieties *Zöld óriás*, *Szentendrei fehér* and *Höning legkorábbi* have proved to be the best pollinating varieties.

In the varieties examined also a parthenocarpic trend can be demonstrated, in *Zöld óriás* consistently while in other varieties in some years.

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RESEARCH WORK ON HYBRID WHEAT AT MARTONVÁSÁR*

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After detailed literary expounding, the authors submit the results gained in their investigations on 1. the cytoplasmic male sterility and fertility restoring genetic systems, 2. the effect of heterosis and 3. the flowering-biological problems of growing hybrid wheat seed.

Several cytoplasmically male sterile and restorer sources have proved to be equally stable and efficient in green-house and in field generations.

Depending on the sub-lines selected from the restorer source, on the wheat varieties to be turned into restorers and on the biotypes selected in varieties, respectively, the efficiency of the restorer might be different.

The observations made on the diameter of the fertile and sterile pollens, the shrivelling of the cytoplasm of the sterile pollens as well as on changes in their colour and form determined in the course of development, might claim attention from the point of view of pollen-examining methodology.

In examinations concerning combining ability carried out in two spacings (10×5 and 10×10 cm) and four series, when compared with the better standard, one combination ($Y \times X$) in F_1 has showed an especially considerable heterosis effect. The parent varieties sown of this combination are for the time being *Ms Y³* and *Rf X³*.

On the basis of mainly earlier publications (RAJKI, E. 1960, 1961a, 1961b, 1962a, 1962b, 1962c) the authors summarize the results of flowering biological investigations carried out at Martonvásár that could be of use in growing hybrid wheat seed.

I.

In the case of wheat with bisexual flower — similarly to sorghum, — no hybrid seed can be produced on commercial scale by way of manual emasculation (and wind pollination). However, the practical utilization of heterosis i.e. the economical production of hybrid wheat can be accomplished in possession of male sterile, sterility maintaining and fertility restoring genetical mechanisms. Today this can be considered realized mainly as a result of some Japanese and American investigations.

In the inheritance of the type of male sterility that can be used for the purpose, essential role is ascribed to the cytoplasm, therefore this kind of male sterility is called cytoplasmic. According to BAHN (1964) inheritance is cytoplasmic if some property of the mother plant can be evinced unchanged in the progenies, and the uniform inheritance of the trait might be established even

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in the case of the change of the chromosome set. The cytoplasmic transfer of traits, thus the transfer of male sterility, too, is much quicker than in the case of inheritance attributed to chromosomes because, — expressed in a figurative way — only the nucleus of one plant, i.e. of that we want to transform, must be substituted in the sterile cytoplasm of the other plant.

1. It was KIHARA (1951) who first reported on the cytoplasmic male sterility of wheat. Substituting the nucleus of hexaploid wheat in *Aegilops caudata* L., male sterile but female fertile wheat plants have developed. FUKASAWA (1953, 1955) substituted the nucleus of *T. durum* Desf. to such *Aegilop-tricum* the cytoplasm of which came from *Aegilops ovata* L., thus producing male sterile plants.

WILSON—ROSS (Fort Hays, Kansas, USA) started a hybrid wheat producing programme in 1958 availing themselves of the hexaploid *ovata*-type cytoplasmic male sterile plant material. As sources for male sterility and restoring fertility some other species of *Triticum* and *Aegilops* were used by them; the greatest success of these was shown by *T. timopheevi* Zhuk. The first really promising stable male sterile hexaploid wheat strains were produced by WILSON—ROSS (1962b).

SCHMIDT—JOHNSON—MAAN (1962) have confirmed the stability of the *timopheevi*-type male sterile system, and reported on fertility restoration isolated in a *T. timopheevi* Zhuk. \times *T. aestivum* L. hybrid offspring. In the autumn of the same year (1962) WILSON who, in the meantime had become a wheat breeder of DeKalb Agricultural Association, reported on the discovery of an efficient male fertility restoring system the source of which had also been *T. timopheevi* Zhuk. (LIVERS—HEYNE, 1963).

Principally, the realization of a new possibility might be considered in the report of SAVČENKO—LASTOVIČ (1964). who started to search for cytoplasmically male steriles in the varieties of *T. aestivum* L. in the year 1959. In 1960 they observed and isolated such male sterile plants that, later on, proved to be cytoplasmically male sterile. According to recent information (LUKYANENKO, 1965) SAVČENKO—LASTOVIČ have succeeded also in isolating the fertility restorers in high-yielding *aestivum* varieties. The isolation of male steriles in common wheat varieties can be explained by the hypothesis laid down several times (Soó, 1953; ŽUKOVSKIJ, 1964) according to which male sterility is a normal phenomenon: evolution from the bisexual plant to the unisexual one, from the unisexual to the monoecious, and from the monoecious to the dioecious.

The isolation of male steriles in *aestivum* varieties is — parallel with other isolating procedures — being dealt with in Martonvásár, too (RAJKI, 1964).

In the context of male sterility and pollen sterility the report of POLOVINKINA (1963) is worth of attention; according to it at least 50% fertile pollens

are required for the dehiscence of the anther. In LUBIMOVA's opinion (1960) the bursting of anthers depends on two circumstances: *a*) on the quantity of fertile pollens and *b*) on meteorological conditions prevailing during flowering. At low atmospheric humidity (30–35%) not even 60–65% fertile pollens are enough for the dehiscence of anthers. On the other hand, in warm weather, at high atmospheric and soil humidity as much as 45–50% fertile pollens are sufficient for dehiscence.

According to the statement of Poddubnaya—Arnoldi (1960) the pollen being very different from the normal, is sterile and might get degenerated in the different phases of its development. Meanwhile the nuclei and the plasma shrivelled considerably, they perish gradually and the pollen becomes empty.

In the case of wheat for the practical utilization of heterosis, besides the genetical mechanism of cytoplasmic male sterility and of restoring male fertility (1), the realization of at least two conditions is required (Borlaug—Ortega et al., 1964): 2. considerable heterosis effect and 3. a method for producing hybrid wheat seed economically on large scale the elaboration of which would require the solution of quite a series of flowering-biological, sowing and other seed producing problems.

2. Every wheat breeder working with numerous combinations may have often observed heterosis (Borlaug—Ortega et al., 1964). Briggles (1963) in his review written on wheat heterosis, refers to 22 authors (Freeman, 1919; Griffiee, 1921; Sax, 1921; Clark—Hooker, 1926; Rosenquist, 1931; Engledow—Pal, 1934; Kučumov, 1937; Pal—Nek—Alam, 1938; Harrington, 1940; Melničenko—Tregubenko 1940; Granhall, 1943; Varenica, 1946; Boyce, 1948; Palmer, 1952; Polishčuk, 1957; Cho—Chiang, 1957; Skurigina, 1958; Sikka—Jain—Parmar, 1959; Gandhi—Uma Menon et al., 1961; Lupton, 1961; Stuber—Johnson—Schmidt, 1962; Schmidt—Johnson—Maan, 1962)*. These studies as well as the statements of Briggles—Daum—Stevens (1964), Kronstadt—Foote (1964), Knott (1965) and Shebeski (1965) issued since the publication of the review are of limited value concerning their applicability in practice. In many a case they refer to the heterosis appearing in plant-height, maturity, in the tillering capacity, grain size, the weight of plant-parts above the surface of the earth, and only a few refer to the entire crop. The majority of the publications are based on examinations made with a limited number of plants and often under green-house conditions. Even in the case of field examinations, the data generally refer to certain rows of F_1 plants without repetition, or to experiments set at few series only.

With full knowledge of breeders' observations and the results of examinations concerning combining ability as well as of the fact that great variation

* The list of references in Briggles's review (1963).

is found of types multiplying and being maintained by self-pollination within the *Triticum* genus and its species, according to BORLAUG—ORTEGA et al. (1964), HEYNE (1965) and SHEBESKI (1965) the heterosis obtained in the combination of a good hybrid wheat is at least of such a degree as can be observed with maize or sorghum.

3. In the opinion of HEYNE—LIVERS (1964) any conclusion referring to the seed producing of hybrid wheat, is to be considered as speculation for the time being. At the same time they remark that in special literature quite a series of isolated facts can be found referring to the problem and these might render further studies easier.

Thus, when examining open flowering with free pollination, LEIGHTY—SANDO (1924) have found, under optimum conditions, 5% of flowers with which the anther got stuck within the glumes. According to GORIN (1953) the rate of open flowering changes depending on the variety. Thus, in the case of *Lutescens* 62 the number of open flowering flowers was in the average of 3 years' observation 80.2—95.3%, while with *Marquis* this was 66.0—66.8%. Similar data were obtained on the open flowering of wheat by PERCIVAL (1921), ABRAMOVA (1950) and VOLODIN (1955.)

According to the examinations of CAHN (1925), TER-AVANESYAN (1946) and GORIN (1950), the number of pollens to be found in the anthers is around 1000. Of course, we should not disregard the fact that the majority of the anthers get generally dehiscent in the flower already, and part of the pollens fall on the own stigma. The investigation of GORIN (1950) and PERUNOVA (1954), however, have proved that immediately after the dehiscence of the anthers, only an average of 100—200 pollens can be counted on the pistils. This shows that on the protruding of the anthers, the majority of the pollens get into the open.

In the case of plants with emasculated flowers exposed to free (wind)-pollination and being 10, 25 and 75 m far from the pollen supplying wheat field windward SOROKIN (1940) has obtained — according to the distance in question — 65.6%, 65.2% and 36% of seed setting. WILSON—ROSS (1962a) had the plants removed from winter wheat fields in strips being 15, 10 and 5 feet broad, and in spring they placed here male sterile plants that had been pre-raised in pots. At the high flowering of the pollinator plants the average seed setting on the male sterile plants was 71%, and the distance between the male sterile and pollinator plants — within the distances examined, — caused but insignificant differences in seed setting.

When examining the fertilizing capacity, NOSATOVSKIJ (1950) found that in general the pistil got fertilized until the 8th day, however, the percentage of seed setting considerably decreased from the 3—4th day on. The data of PERUNOVA (1954) and SÁRIČ (1957) also prove the relatively long viability of the pistil.

As to the fertilizing capacity of the pollen, information in this field might be contributed to by the data of KULBIJ (1959) according to which under field experiment conditions in the anthers gathered for artificial pollination, the pollen loses its fertilizing capacity in 15—20 minutes.

In the interest of enhancing the economical production and utilization of hybrid wheat seed, American hybrid wheat breeders are greatly concerned in the possibilities of diminishing the seeding rates. BORLAUG—ORTEGA et al. (1964) establish that for the time being the rates in wheat seeds are the 6—12-fold of those of maize, and 10—40-fold of those in sorghum. They are convinced that when using good-quality seed, the rate of seeding used by most farmers, could be decreased to the half without affecting yield adversely. Further feasibilities for diminishing the seeding rate might be brought about by applying modern methods for the preparation of soil, as well as up-to-date fertilizing, weed control and irrigation methods and, last but not least, the improvement in design of wheat grain drills.

The most important results now available in the three fields of hybrid wheat investigation being discussed in this paper, have recently been summarized in a review (RAJKI, 1965). Now we are going to submit — in the three systematical divisions already mentioned, — the results obtained in hybrid wheat investigations carried out at Martonvásár, while the results already published will be only referred to.

II.

1. We have carried out experiments with *timopheevi*-, *caudata*- and *ovata*-type male steriles produced in winter and spring *aestivum* and *durum* varieties as well as male steriles isolated in *aestivum* varieties. This gives altogether eight controlled male sterile sources. The source of all the three fertility restorers used was *T. timopheevi* Zhuk., of these a WILSON-type restorer of sterile cytoplasm being examined in the first place.

Since under our conditions only the male steriles and restorers produced in winter wheat might practically be of importance, the plant material is treated accordingly. With the aid of our green-houses and the well-known vernalization technique, we manage to raise two generations yearly. In the first case, we sow in autumn vernalized seeds in pots and keep them in the open, while from the middle of November, in green-houses being heated and artificially illuminated; these are harvested in January. In the second case the vernalized seed is sown in the field directly and as early as weather conditions make it possible, — generally in the second half of March. The second plant generation is harvested in the first half July.

For laboratory pollen examinations the flowers of the plants are emasculated and the removed anthers are fixed in CARNOY I. for 8—12 hours. Outwash

is performed with 80% alcohol, then up to the time of staining and examination respectively, the anthers are kept in 70% alcohol. Staining and examination are carried out on slides. A few drops of carmine acetic acid are dripped on the slide and the anthers put in this. In three repetitions per ear, 3—3 anthers are placed per preparation on one slide. Then they are covered with a cover glass and squashed by slight pressure. During staining the preparation is not decocted, instead we apply the long-lasting method of staining. In one preparation the number of sterile and fertile pollens are established in 10 visual fields. The examinations are carried out with a *Leitz—Ortholux* microscope in 15×10 magnifying.

Fertile pollens are considered what, in spite of being somewhat oval, differ but little from the circular form, get stained bright pink and after staining their cytoplasm shows fine granular structure when being examined in a microscope of normal light (Fig. 1).

Sterile pollens are called what are deformed and get stained only a little or not at all and when examined in a normal-light microscope, the cytoplasm does not show fine-granular structure (Fig. 2).

Both with the male sterile and restorer sources the stability of male sterility and fertility restoration and the efficiency of these mechanisms are examined.

a) In order to establish the stability of male sterility, the *A*-lines (cytoplasmically male sterile sources) are continuously back-crossed with *B*-lines (normal variety, recurrent partner that maintains male sterility and does not restore male fertility). The ears of plants raised from seeds thus obtained are isolated, from other ears of the same plant anthers are gathered with the purpose of establishing the rate of male sterility and pollen sterility, respectively. The stability of male sterility is concluded by seed setting observed in isolated ears and by the rate of pollen sterility, the latter being established by the carmine acetic acid quick method described above.

Both in green-house and field generations the *caudata*-type *A*₁-line has proved to be perfectly male sterile (in isolated ears 0 seed setting) and pollen sterile (100% sterile pollen), however, in *A*₁ × *B*₁ seed setting is very poor.

3 *Timopheevi*-type *A*-lines (*A*₄-, *A*₅ and *A*₇-lines) proved to be male sterile with which in green house the percentage of sterile pollens was 82, 89 and 95, while in the field generation this was 96, 95 and 85. With the field generation in 1—1 ear 1—1 grain developed in the case of 2 *timopheevi*-type *A*-lines (*A*₂- and *A*₃-lines), as well as in the *ovata*-type *durum* *A*₆-line. The rate of pollen sterility with these lines was in the sequence of enumeration 78, 96, and 61% in the green-house generation and 93, 82 and 89% in the field.

When producing in the green-house *A*₈-line isolated in the *Bez. 1* variety, no grains developed in the isolated ears though the rate of pollen sterility was only 31%. It is a fact, on the other hand, that the pollens determined as fertile,

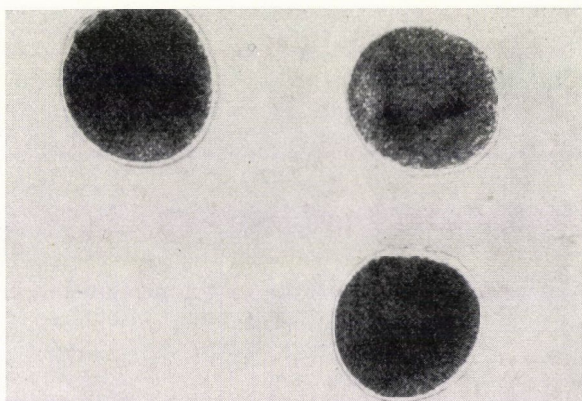


Fig. 1. Fertile pollen. Bez. 1. 40-fold apochromat lens, 4-fold Huygens-ocular (Original)

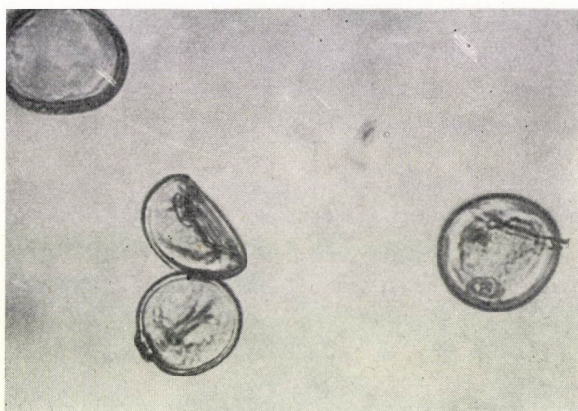


Fig. 2. Sterile pollen. A_1 -line. 40-fold apochromat lens, 4-fold Huygens-ocular (Original)

were plasmolized to a high degree. Under field experimental conditions, however, in the isolated ears of the A_8 -line 17 grains developed on an average and the rate of sterile pollens was also only 15.

b) The efficiency of sterility mechanisms was studied in the course of turning winter wheats into male sterile both in green-house and field-generations; these had been initiated in varieties being included into examinations concerning combining ability.

In the *caudata*-type A_1 -line \times Fert. 293 BC program we have obtained stable *Ms Fert.* 293 plants (in isolated ears 0 seed setting and 100% the sterile pollen), however, here too, the seed-setting of $A_1 \times$ Fert. 293 is very poor.

Of the sterility mechanisms of *timopheevi*-type the A_2 -, A_3 -, A_5 - and A_7 -lines proved to be very efficient. Thus, e.g. in the case of *Ms Bez. 1*¹, *Ms Fert.* 293¹, *Ms Mir. 808*¹ and *Ms Sk. 3b*¹ plants produced with the A_2 -line the average

percentage of sterile pollens was 91 (84—97) in the green-house; in the field generations of *Ms Bez. 1²*, *Ms Fert. 293²*, *Ms Mir. 808²* and *Ms Sk. 3b²* plants this was 93 (89—94), while in isolated ears not a single grain developed.

In the isolated ears of plants obtained from the crossing of *timopheevi*-type *A*-lines with certain varieties, a considerable number of grain developed and the ratio of fertile pollens was also high. The examination of this plant material is also under way.

It should be noted that the data submitted concerning the stability and efficiency of male sterility, refer to the 1965 investigations and in their tendency they agree with those of the previous year.

c) The data to be submitted on the stability and efficiency of the restorer, refer to a WILSON-type restorer of sterile cytoplasm (*R_w*-line).

In the examined *R_w*-line, from generation to generation, such plants and sublines, respectively, are selected in which pollen fertility is high and the grain/ear value is the greatest. As a result of selection in the *R_w*-line, the 63% pollen fertility value found in the field generation of 1964 changes to be 74% in the 1965 green-house generation, and to 81% in the field generation. This renders it possible to select sub-lines from *R_w*-line being more stable and efficient than the original one.

d) The efficiency of fertility restoring mechanism is being studied in the course of turning certain winter wheat varieties to restorer.

Depending on the sub-lines selected in the *R_w* line and on the wheat varieties to be changed into restorer as well as on the selected biotypes of the same varieties, the rate of pollen fertility and seed setting might be different with the plants of the *BC* generations. This is proved by the data of Table 1.

Table 1
Pollen fertility and seed setting when turning to restorer

Ser. No.	Combination	% of fertile pollens				Seed setting
		In the plant used of <i>R_w</i> -line, 1964	<i>F₁</i> , in the greenhouse, 1965	<i>BC₁</i> , in the field, 1965		Grain/ear
				\bar{x}	Extreme values in ears	
1.	<i>R_w</i> -19-5 × <i>Mir. 808</i> -27	86	64	57	18—90	8
2.	<i>R_w</i> -19-7 × <i>Mir. 808</i> -27	86	74	82	65—94	22
3.	<i>R_w</i> -35-5 × <i>Fert. 293</i> -25	—	65	86	78—90	29
4.	<i>R_w</i> -35-6 × <i>Mir. 808</i> -20	—	68	35	1—86	13

In combinations 1 and 2 the different ears of a single plant served as restorer, while the recurrent partner in both cases was *Mir 808*-27. Viz., pollination was carried out with anthers obtained from a single ear of a plant of the variety *Mir. 808*. And yet, the seemingly minimal difference in the restorer

was enough for gaining very divergent pollen fertility and seed setting values in the plants of the BC_1 generation.

In combinations 3 and 4 there was again a seemingly slight difference being identical with the previous one, between the restorers. Here, however, as recurrent partners different varieties served: the *Fert. 293* and *Mir. 808*. Thus, essentially it is the latter point that gives an explanation for finding the best pollen fertility and seed setting values in the plants of *Rf Fert. 203*² of the four examined cross-progenies in the combination. At the same time in the case of the plants of *Rf Mir. 808*² the values mentioned were the least of the 8 cross-progenies examined in the combination.

It is noteworthy that in F_1 , under green-house conditions, the values of pollen fertility have not considerably differed from one another in either of the combination-pairs.

It is interesting to compare the pollen fertility values of *Rf Fert. 293*² (Table 1, comb. 3) and of *Rf Mir. 808*² (Table 1, comb. 2) with the pollen fertility values of some *B*-lines viz., varieties submitted in Table 2. As can be

Table 2
Pollen fertility and seed setting in *B*-lines, 1964/1965

B-lines	Per cent of fertile pollens				Seed setting
	In the greenhouse		In the field		
	\bar{x}	Extreme values	\bar{x}	Extreme values	Grain/Ear
B ₂ —line	85	79—90	87	86—90	25
B ₄ —line	72	62—87	87	83—93	27

Table 3
Diameter of the fertile and sterile pollens of the *A*- and *B*-lines

<i>A</i> -lines	Diameter of		<i>B</i> -lines	Diameter of	
	Fertile	Sterile		Fertile	Sterile
	pollens μ			pollens μ	
<i>A</i> ₂ -line	45.90***	44.71***	<i>B</i> ₂ -line	57.55 ⁺⁺⁺	49.56
<i>A</i> ₅ -line	47.94***	45.65	<i>B</i> ₅ -line	51.68 ⁺⁺⁺	47.94
<i>A</i> ₇ -line	46.92***	46.41***	<i>B</i> ₇ -line	53.89 ⁺	50.83

* indicates the significance between the diameters of sterile pollens in the *A*- and *B*-lines, and of fertile pollens in the *A*- and *B*-lines.

+ indicates the significance between the diameters of the fertile and sterile pollens of the *A*-lines as well as those of *B*-lines

*** or +++ at the level $P = 0.01$.

* or + at the level $P = 0.05$.

seen from the data, there is no considerable difference in the pollen fertility values submitted. The same refers to the pollen preparations, too (cf. Figs. 3 and 1.)

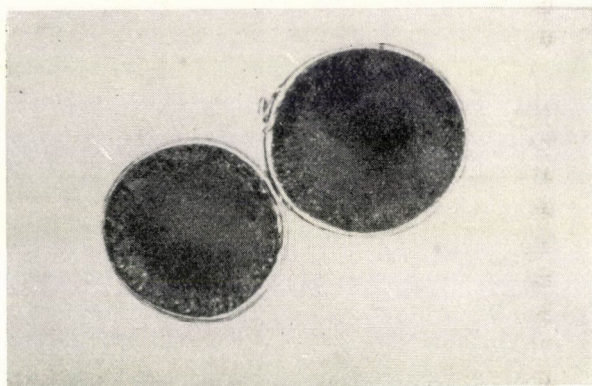


Fig. 3. Fertile pollen. Rf Fert. 293¹. 40-fold apochromat lens, 4-fold Huygens-ocular (Original)

We have to mention at the same time that in the examined *R*-line there is a greater difference between the field - and green-house pollen fertility and sterility values respectively, (pollen sterility is more expressed under green-house conditions) than in the *A*-lines.

e) Here we want to mention certain methodological statements on pollen analysis.

The diameter of the fertile and sterile pollens in *A*- and *B*-lines is shown in Table 3. The data of the Table show that concerning the diameter, no significant difference can be established between the fertile and sterile pollens of the *A*-lines. On the other hand, between the diameter of the fertile and sterile pollen in the *B*-lines the difference is significant at the different levels of probability shown in the Table to the advantage of the fertile pollens.

When comparing the fertile pollen of the *A*-lines to those of *B*-lines or, in agreement with the former, the sterile to the sterile, — we might observe a significant difference between them at the different levels of probability as shown in the Table. Viz., the diameter of the fertile and the sterile pollen in the *B*-lines is significantly greater than that of the fertile and sterile pollen of the *A*-lines.

The diameter of the pollens has been established with the aid of a Zeiss helical measuring ocular, with Zeiss—Lumipan microscope.

When examining the pollens we have observed the shrivelling of the cytoplasm. This phenomenon, as it is well-known, — might be the effect of CARNOY I. fixing agent that causes the cytoplasm to shrivel.

In the course of our pollen analyses, with those forms, however, where we have found a lot of pollen with shrivelled cytoplasm, there was no seed

setting when pollination had been carried out with this pollen. This phenomenon admits the conclusion that the shrivelling in the cytoplasm of the pollen might be brought about not only under the fixing effect of CARNOY I: the trend to shrivelling is an aptitude of the pollen, and thus CARNOY I. only increases shrivelling (Fig. 4).

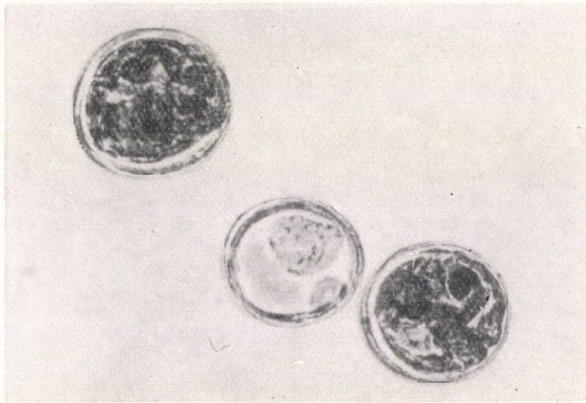


Fig. 4. Shrivelled sterile pollen; the cytoplasm not displaying fine-granular structure. Ms Fert. 293¹. 40-fold apochromat objective, 4-fold Huygens-ocular (Original)

When the pollens of shrivelled plasm are being stained further on by way of heating, either no generative nuclei are found in such pollens or their development has stopped in the initial stage, or again it may have been accomplished abnormally.

When removing the anthers, an interesting phenomenon could be experienced: the pollen sac of the *A*-lines is much lighter in colour, being yellowish-green thus differing from the colour of the *B*-lines or varieties. As to their size, the anthers are smaller in the *A*-lines, and it often occurs that an anther is missing in the flower. These light coloured anthers will not swell, do not protrude from the flower at all. In a later stage of their development the lower part of those anthers curl up in a fork-like manner.

2. In order to examine the combining ability, we made, in 1964, 11 crossings partly with indigeneous and partly with foreign winter wheat varieties, in 15 combinations. Only such winter wheat varieties were crossed the large-scale growing of which can be carried out efficiently under conditions prevailing in this country.

Of the 15 combinations there was with 11 only direct crossing, with two of them both direct and reciprocal crossings. According to combination we have obtained different amounts of grains of wheat and depending on the number of these, we applied two kinds of sowing method in the 1965-year performance trial.

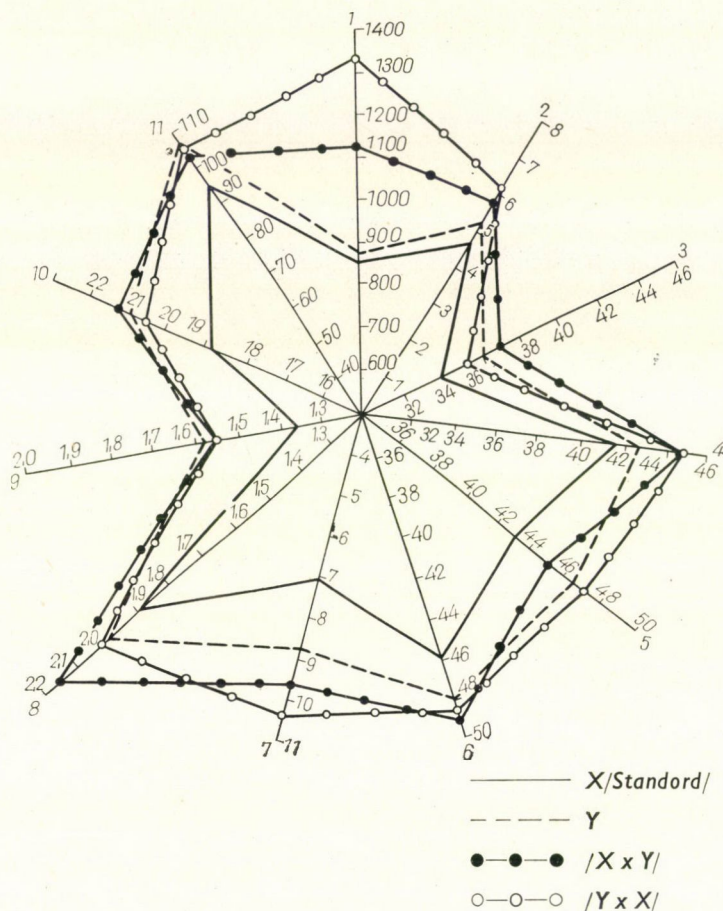


Fig. 5. Some properties of the parent varieties and of the F_1 hybrids

1. Yield of grain/variant, g; 2. Productive tillering, piece; 3. Grain/ear, piece; 4. Grain/main ear, piece; 5. Weight of 1000 grains, g; 6. Weight of 1000 grains in the main ear, g; 7. Weight of grain/plant, g; 8. Weight of grain/main ear, g; 9. Weight of grain/secondary ear, g; 10. Spikelet/main ear, piece; 11. Plant height, cm.

a) In four series, in each of which altogether 320 seeds per combination were sown in four rows with a row space of 10 cm and a plant space of 5 cm. There were 6 such combinations.

b) In four series, and in four rows per series, altogether 160 seeds were sown for each combination at 10 cm \times 10 cm spacing. There were 10 such combinations of which 4 had already been used in the first method of seeding, however, 160 seeds remained there over after sowing, and there were 6 cases when there was no sufficient seed for the first kind of sowing method.

Seeding was arranged in rectangular lattice design. Together with the F_1 hybrids the parents, too, were sown; among them are the two standard

varieties: *Bez. 1* and *Fert. 293*. The experiment, even in statistical evaluation, was reliable.

There were several combinations that have considerably surpassed the standards concerning grain yields. The best combination with 10×10 spacing has produced a yield being by 56% higher as compared with the better standard also sown in 10×10 spacing. It is worthy of attention that the grain yield of the combination showing that outstanding heterosis effect with 10×10 spacing, has surpassed by 28% the grain yield of the better standard found with 10×5 spacing, too.

In Fig. 5 we demonstrate the properties of the best combination in direct and reciprocal crossings, together with the parents. One of the parents (*X*) was the better standard. The yield of the other parent variety (*Y*) surpassed a little but not significantly, the yield of the standard.

When comparing the yield data of the direct and reciprocal crossings and comparing them to the standard, it can be seen that, in general, the hybrids produce higher values. In three properties: productive tillering, number of grains in the main ear, and weight of 1000 grains, $P = 0.01$, also a significant difference appeared between the standard and the hybrids to the advantage of the latter.

Practically, also from the point of view of decreasing seeding rate, it is promising that parallel with the productive tillering of the hybrids, the weight of 1000 grains also increases.

It is to be observed that the parent varieties of the hybrid combination described here are for the time being, sown in generations *Ms Y*³ and *Rf X*³.

3. In the flowering-biological researches carried out at Martonvásár, in the species *T. aestivum* L. considered to be predominantly a self-pollinating plant, open flowering was established to be 82,4–98% while in the species *T. durum* Desf. up to 100% (RAJKI, E. 1960).

In the case of emasculated wheat flowers exposed to free (wind) pollination, seed setting was between 63.1–97% (RAJKI, E. 1961a). These values hardly lag behind the seed setting values noticed with wheats without any intervening (Table 4). The statement according to which with the increase

Table 4
Seed setting in the wheat *Bánkúti 1201* in the case of
various pollination methods

Ser. No.	Method of pollination	Seed setting %	
		1956	1957
1.	Without emasculation or any other intervention	85.0	90.2
2.	Emasculated flowers exposed to free (wind) pollination	81.0	86.5

of pollinating days, the seed setting percentage increased proportionally, — is also worthy of attention (RAJKI, E. 1961a).

The viability of the stigma is also long, i.e. it is receptive to fertilization for a rather long time: at Martonvásár this is generally a period of 6—13 days depending on the weather. In dry and warm weather the rate of wheat flowering is quicker than at the time of abundant rainfall. Fertilization might occur also in the first and last i.e. the eighth stage of stigma development, however, seed setting is best if on the occasion of fertilization the stigma is in the following stages: 4. (the pistil is protruded well, the lobes are developed) and 5. (the pistillobes have got beyond the glumes, the ovary has increased considerably) (RAJKI, E. 1961b).

The development process of the anthers, — similarly to the stigma, — is quicker in dry than in rainy weather since the protruding of the anthers, as proved by the relevant examinations, gets quicker in dry and warm weather. It has also been established that the rate of seed setting is determined primarily by the developmental conditions of the stigma because even if the fertilization is carried out with pollens of anthers being in different developmental stages, — highest seed setting is always obtained with a stigma the developmental stage of which is the most advantageous for fertilization. It is to be mentioned that the time of fertilization is less with the pollens of the anthers than with the stigma (RAJKI, E. 1962b).

We have also examined the role of the flowering times of mother plants and of pollinating plants, the coincidence of flowering in seed setting. It has been established that an important condition of good seed setting is that the earing or flowering in the mother plants should occur by 1—2 days earlier than that of the pollinators. In this case the flowers of mother plants have been already open and ready to accept pollen at the time when flowering on the main ears of the pollinator plants begins (RAJKI, E. 1962b).

As to the importance of the quantity of pollen in seed setting, the investigations carried out at Martonvásár might offer some basis for information in this problem. When removing one or two anthers from the flowers and, further, if pollination has been performed with one, two and three anthers, respectively, the value of seed setting percentage has increased with the increasing number of anthers. I.e. the rate of seed setting was higher when pollination had been done with the pollens of three anthers. It has also been established that by increasing the number of anthers on the occasion of pollination, namely, passing more anthers on the stigma, the number of pollens on the stigma increases also in direct proportion, the rate of seed setting will be higher and the average weight of wheat grains also increases (RAJKI, E. 1962a).

In the course of investigation there were equally advantageous and disadvantageous years for flowering, pollination and fertilization. Therefore, flowering biological data and statements, respectively, presented herein on the

basis of our previous publications (with the exception of only one Table, that of No. 4), are promising regarding the economical solution of growing hybrid wheat seeds.

*

We want to conclude the present report with the idea previously suggested by BORLAUG—ORTEGA et al. (1964) that by the realization of hybrid wheat, wheat variety breeding will not become unnecessary. On the contrary, successful hybrid wheat program in the long run cannot be imagined without effective wheat variety breeding.

Therefore, at Martonvásár, besides the intensive development of hybrid wheat investigations the intensity of wheat variety breeding that has been going on for ten years, cannot decrease in the future either; the first result of this work is our *Mv 65—07* candidate for wheat variety being already included in the state performance trials.

Only better and better wheat varieties might serve as a basis of producing new hybrid combinations. Thus, the producing of hybrid wheat and the breeding of wheat varieties, will exist parallel, in future, too.

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HONEY BEE ACTIVITY IN ALFALFA (*MEDICAGO SATIVA* L.) POLLINATION IN HUNGARY*

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The activity of honey bees on fertilization and seed setting was respectively examined in different distances from the hives in an area of 52 hectares of flowering alfalfa field. To establish the tripping effectivity of inexperienced nectar collecting young bees and that of the experienced older ones, further observations took place.

Compared with the farthest section visited exclusively by wild bees the fertilization and seed setting was respectively 34 and 35 per cent higher in two sections where the largest number of honey bees could be observed.

On an average of about 50 per cent of visited flowers are tripped by young honey bees inexperienced in nectar collection. The tripping effectivity of the older bees experienced in nectar collection was 4—6 percent.

The great fluctuation of the seed yield of alfalfa, one of the most valuable forage crops, causes a serious problem all over the world. As generally known, the work of pollinating insects is one of the most important factors of a successful alfalfa seed production. The wild bee population is relatively rich in Hungary due to dry climatic conditions of the country. Thus, at first view the natural pollination and fertilization of alfalfa flowers seem to be sufficiently warranted. In spite of the fact a considerable increase of seed yield per unit-area meets with difficulties in which a not insignificant part is played by the uncertainty of an adequate frequency of the natural insect pollinators.

Early Hungarian investigations into the pollination of alfalfa intended to approach first of all those problems that depend largely upon the natural conditions given by the geographical situation of the country. Thus co-operative experiments conducted for a number of years under different natural conditions (Sweden, Canada, Hungary) confirmed that the automatic tripping accompanying self-pollination was within the range of 13 to 30 per cent of a regular occurrence in Hungary. In the same experiments in Sweden and Canada automatic tripping fluctuated between 31 and 65 per cent (LESINS—ÅKERBERG—BÓJTÖS 1954). In Hungary the frequency of automatic tripping was reduced mainly by the relative individual abundance of tripping insects.

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Fertilization from untripped flowers occurs also in Hungary only in exceptional cases and the seed yield resulting from such flowers is insignificant (BÓJTÖS 1951; LESINS—ÅKERBERG—BÓJTÖS 1954).

In the co-operative experiments the tripping was in Hungary with 13 to 73 per cent and in Sweden only with 4 to 18 per cent more frequent in flowers freely visited by insects than in those from which insects were kept away by guards. These percentage values are in correlation with the daily average number per hectare of tripping wild bees which fluctuated between 1400 and 3800 in Hungary and between 16 and 800 in Sweden.

Though experiments confirmed that seed setting might occur also without the intervention of insects to some extent, the insect-ensured cross-pollination is still more advantageous also biologically and leads furthermore to a better pod setting and a higher seed number per pod. Consequently attention was increasingly given to pollinating bees also in Hungary. In result of the three year experiments performed in 10 regions of the country, in the first year 66 and in the subsequent two years further 33 *Apoidea* species, subspecies, variations and forms visiting alfalfa flowers could be demonstrated (MÓCZÁR—BÓJTÖS, 1957; MÓCZÁR 1961a). According to examinations *Eucera clypeata* Ev., *Melitta leporina* Pz., *Andrena ovatula* K. and *Bombus lapidarius* L. proved to be the most important alfalfa-pollinating species (MÓCZÁR—BÓJTÖS 1957; MÓCZÁR 1959; MÓCZÁR 1961b) and on the basis of three years country average a number of 4200 wild bees per hectare could be ascertained (MÓCZÁR 1961c).

These data compared with a large number of foreign investigations confirm that — regarding the richness in alfalfa pollinating wild bees — Hungary holds an eminent position. However, when also the number of flowers per unit-area is taken in consideration the question is problematic. LESINS (1950) reckons with 500 million flowers per hectare, while according to HALIFMAN (1953) about 50 million flowers bloom daily on a hectare of a good alfalfa field. On the basis of Hungarian investigations the number of flowers visited daily by wild bees could be estimated for 1954 only at 17.4 millions per hectare during 5 hours daily on the country average. Even on the experimental region showing the largest frequency of wild bees the visit of only 25.5 million flowers per hectare daily can be counted upon (MÓCZÁR—BÓJTÖS 1957). The findings that frequency of pollinating wild bees is fluctuating everywhere (LESINS 1951) and the optimum frequency occurs only in quite exceptional cases (TYS DAL 1946; TODD 1957) can be held as generally valid. The fact that the calculated possible seed yield in alfalfa is 1500 to 2000 kg per hectare points likewise to it (ÅKERBERG 1960). To approach even such a seed yield quantity is difficult in the practice.

In the last years the highest alfalfa seed yield has been obtained all over the world on those fields where the number and work of pollinating insects were increased by artificial ways. Two principal methods are available for

this purpose: 1. increasing the population of wild bees by artificial rearing and 2. control of the pollinating work of honey bees.

Though some initial results may be recorded in the artificial rearing of wild bees, particularly of *Bombus* species, a rapid practical solution can however not yet be generalized. This is the reason why the attention is more and more directed also to the honey bee. As known the views regarding the pollinating activity of honey bees on alfalfa flowers are still contradictory. Essence of the problem may be summed up in the fact that the flower is tripped well by honey bee during pollen collection, but only occasionally during nectar collection and the honey bee takes part in the pollination accordingly.

Though during the experiments performed earlier in Hungary the alfalfa flower was visited by heavy swarms of honey bees flying-in from larger distances, pollen collecting bees were present only in a small number among them. The several thousands of observed honey bees took part merely in 1 to 5 per cent in the pollination (BŐJTÖS 1951; LESINS—ÅKERBERG—BŐJTÖS 1954; MÓCZÁR—BŐJTÖS 1957). As demonstrated by 3 years observations of MÓCZÁR (1961d) the work of honey bees regarding the number of flowers per hectare tripped during one minute was — in spite of their low effectivity — exceeded only by the two most active wild bee species, on account of the large individual density of honey bees.

On the basis of these latter data and of the over increasing number of positive results of foreign investigations (VANSELL—TODD 1946; HARE—VANSELL 1946; KNOWLTON—SORENSEN 1947; LINSLEY—MACSWAIN 1947; SOLOVIEV 1947; PEDERSEN—TODD 1949; SOBOLEVA 1952; VANSELL 1955; BOHART 1957; LEVIN—BOHART 1957) a further study of the pollinating role played by the honey bee appeared necessary also in Hungary.

Having this in view 70 well developed bee-colonies were placed on one edge of a 52 hectares flowering alfalfa field at the end of July 1961. In one km. radius from the alfalfa only maize and a ploughed cereal stubble were situated. The influence of bees on fertilization and seed setting respectively was examined. On a stripe corresponding to the width of the hives laid out, to a distance of 400 m. from the hives, eight sections each of 50 metres were designated. In each section 100 plants of average development were examined, with 12300 flowers per section on the average. In the sections situated in different distances from the hives the fertilization of flowers was determined on the basis of the pod-setting percentage. The average fertilization percentage of the individual sections is illustrated on Fig. 1.

Due to the relatively small number of hives per 1 hectare, already at a distance of 350 to 400 m. from the hives practically no honey bees were found any more, as no flying-in occurred from the opposite direction. Since only wild bees were active in this farthest section, the 42.5 per cent fertilization found

here demonstrated only the influence of wild bees. The largest number of honey bees could be observed on flowers with a higher nectare-content of the more luxuriantly developed vegetation in two sections situated at 100 to 200 m. distance. (On favourable days their frequency fluctuated between 30000 and 40000 per hectare.) In the two sections situated at 100 to 200 m. distance the

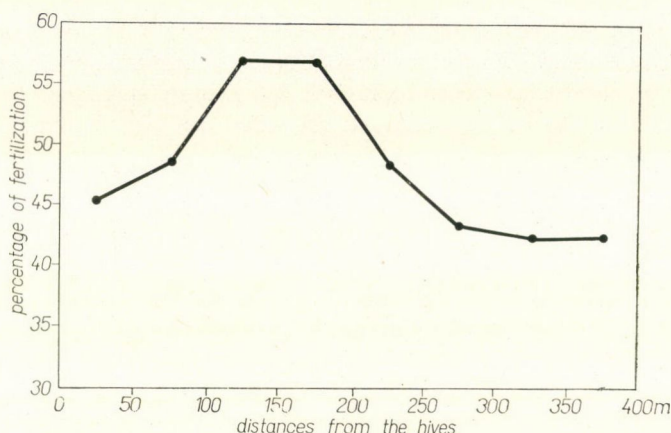


Fig.1. Influence of 70 honeybee-colonies on fertilization placed on a 52 hectares flowering alfalfa field. Füzesabony, 1961

fertilization was 57.0 and 56.9 per cent respectively. Related to the last section visited exclusively by wild bees this fertilization corresponds to a 34 per cent increase.

A similar, 35 per cent increase is confirmed also by the average number of seeds per 100 flowers, which was 173 in the farthest section against 235 in the two sections situated at 100 to 200 m. distance.

Pollen collecting honey bees could be but rarely noticed as the maize flowering in the neighbouring fields served as an abundant pollen source. On the other hand by means of the bee-keepers it could be observed that the flowers were generally well tripped, in some cases even in 75 to 100 per cent by the mainly young, in nectar collecting inexperienced bees. According to our presumption the positive result is to be attributed mainly to the daily presence of a large number of young, inexperienced bees in the populous colonies. This is in conformity with observations of PEDERSEN—TODD (1949).

To establish the proportion in which the visited flowers were tripped by the inexperienced nectar collecting young bees, our observations were continued in August 1962 in two different localities (Füzesabony, Martonvásár). On the first three days of investigations conducted with 100 colonies brought over from another plant culture, the tripping effectivity of 102 bees alleged to be young by practical bee-keepers was examined on 1186 flowers in the first

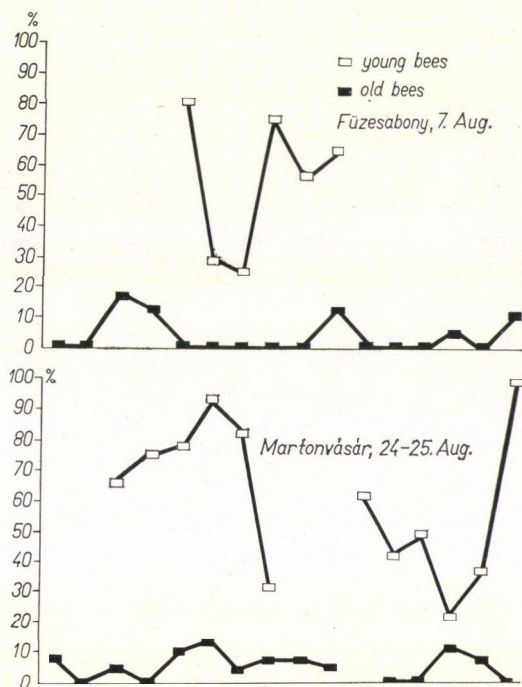


Fig. 2. Comparison of the tripping effectivity of younger, in nectar collecting inexperienced and older experienced, honey bees examined on the same days in 1962 in Füzesabony and Martonvásár

experimental locality. Among the examined bees 6 individuals attracted attention from afar by their very inexperienced visiting of the flowers; they tripped 54 per cent of the visited flowers on the average with 25 to 80 per cent extreme values. The other — likewise more or less inexperienced — bees tripped 26 per cent of the flowers. Otherwise among the examined 102 bees the tripping effectivity of 16 individuals attained or exceeded the 50 per cent value.

In the second experimental locality (Martonvásár) only the work of nectar collecting young bees being strikingly inexperienced had been during 8 days. By recording the flower visiting work of each of the bees until their flying could be reliably followed we succeeded in observing the work of 56 such bees on 589 flowers. Similarly to the result of the first experimental locality, here again 50.3 per cent of the flowers on the average was tripped by these bees. The extreme values varied between 13 and 100 per cent, but among the examined 56 bees the 50 per cent value was attained or exceeded by the effectivity of 28 individuals.

As a control the already known work of 31 bees experienced in nectar collecting — which according to findings of practical bee-keepers are certainly older was again observed for two days in both experimental localities. The tripping effectivity of these bees was 4.4 and 6.0 per cent respectively, on the

average of both experimental localities. Extreme values fluctuated between 0 and 16.7 per cent, among the examined 31 bees however 16 bees did not trip any of 173 flowers. Comparison of the work of inexperienced bees examined on the same days is well demonstrated on Fig. 2.

By our investigations it is confirmed that on account of surrounding natural flora and the abundant pollen source offered by cultivated vegetation, pollen collecting honey bees occur generally in a small number on Hungarian alfalfa fields. About 50 per cent of flowers on the average are however tripped honey bees inexperienced in nectar collection until they acquire an adequate practice in collecting nectar from the particularly built-up alfalfa flowers. These data argue as well in favour of the advantage to change the colonies several times (TODD—VANSELL 1952; LEVIN 1955). On the other hand in the colonies set out in large numbers per unit-area there are always many young bees inexperienced in nectar collecting, the activity of which increases the seed yield, though to a minor or major extent only.

As in the present study the exact age of bees was not elucidated with reliable methods, this fact should by all means be taken into consideration in the continuation of investigations. Furthermore it should also be clarified whether the large number of nectar collecting honey bees is or is not prejudicial to the visiting of flowers by wild bees. In our first year's investigation the number of seeds per pod was — in spite of the poorer seed setting — higher on the section where only wild bees were active (Fig. 1). This points to a more considerable cross-pollination. Thus on the basis of the available further data and presumptions (PETERSEN 1954; LESINS 1961; STEUCKHARDT 1962) it must be made clear also to which extent is cross-pollination ensured on the field by trippings through the agency of honey bees. Therefore a co-operation of plant breeders, seed-growers, entomologists and practical bee-keepers is necessary by all means.

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VARIA

PANNONIA KINCSE

(The Treasure of Pannonia)



Origin: “Szőlőskertek királynője” (Queen of vineyards) muscat × “Cegléd szépe” (The Beauty of Cegléd)

Beginning of Breeding: 1942

Breeder: FERENC POCSIK

Year of state certification: 1959

First acknowledgement: 1959

Morphological description:

Stock: growing vigorously

Banner: light bronze-green, shiny, naked

Leaf: medium-sized, quincunciate-lobed, very similar to that of the “Queen of vineyards”. It is grass-green, with a rather smooth surface. Its upper side hollow is deep, narrow, closing or closed, pointed, the lower one is hollow, generally open. Its shoulder hollow is open, characteristically U-shaped. The reverse is bare, more or less shiny, having bristles at the lower end of the veins only. Veins are rather green being pale pink only at their lower ends. The edge is crenate serrated, deeply indented.

Stem: of a slightly purplish red tinge.

Cluster: big, broad of varying close formation, it resembles Afuz Ali.

Berries: big, oval, frequently date-like, when ripe, they are of a lovely pale amber colour, clinging well to the pedicel crown, they are pulpous, hard, crisp, having few stones. On consuming, its skin is not palpable. The variety is of few stones. Its taste is indifferent, however, very delicious, once thoroughly matured, it is similar to *Afuz Ali* grown in more southern countries. Pressure resistance (2150 g) and breaking resist-

ance (609g) values are twice as high as those of the variety "*Szőlőskertek királynője*" (1000 and 315 g, respectively).

Growing importance: In Hungary it matures at the end of August, somewhat before *Chasselas*. Among the large-berried varieties suitable for export, it has no rival in this country. It is one of the varieties that can be transported best.

The berries are not sensitive to rain, they do not crack like those of "*Csabagyöngye*" or "*Szőlőskertek királynője*". When being grown on breezy areas, it is rather resistant even to rot. Its stalks, however, similar to *Afuz Ali*, are sensitive to cold.

The yield is abundant and reliable. Because of its earliness it can be grown safely at less advantageous sites, too. Concerning soil, it is unpretentious. Growing vigorously, it thrives also on soils less rich in nutritive material.

It is liable to produce a second crop. The second-crop clusters are smaller than those of the first crop, however, the berries are well developed, and will surely get ripe 2—3 weeks after the first crop.

The importance of "*Pannonia kincse*" is to be attributed to its clusters being almost of the same outer appearance and intrinsic values as *Afuz Ali*, to its being very well suitable for transporting and for storage and also to its earliness and high yielding capacity.

In Hungary it ripens by about 40 days earlier than *Afuz Ali*. For the time being it is our most suitable variety for export.

Districts suitable for growing: It is a variety that can be suggested to be grown at large scale in every district determined for growing table grapes. Abroad it has not been introduced yet. Where *Afuz Ali*, due to its late maturing, cannot be grown, it might be well supplemented by "*Pannonia kincse*"

MV. SYNALFA LUCERNA

(*Lucerne Mv. Synalfa*)



Origin: A synthetic variety produced from 15 clones with the polycross method. Of the clone parents 13 originate from the populations of the old „Hungarian lucerne” and 1 each from the oecotype Turkestan and the Old Franconian (blue type) lucerne. The synthetic mixture is characterized by the composition of various proportions of the clone parents.

Breeder: ZOLTÁN BÓJTÖS; in the production of the variety ANTAL GIMESI and JÓZSEF SZMILKÓ participated. Breeding work, was conducted in the Agricultural Research Institute of the Hungarian Academy of Sciences in Martonvásár.

Year of qualification: 1961

Morphological description:

Root: The taproot is strongly developed, with several thinner lateral roots penetrating as a rule downwards in an acute angle.

Stem: Characterized by a strong developed rhizome of manyfold branching, the level of the branching zone (crown) being arranged directly below the soil surface. The shape of grown-up plant is obliquely ascending but in the latter phase of development somewhat bending down. Length of stem medium, thin, of a fine type and strong, in the period of flowering full, almost bare. The branching of the main shoots is more abundant than medium, the angle of the main laterals less acute. Length of the internodes medium.

Leaf: The shape of the characteristically dark green leaflets is oval. The hardly toothed or entire, poorly haired leaflets are less fleshy, tender. The foliage both on main shoot and on lateral branches is equally abundant, its average ratio amounting to 50–52 per cent.

Flower: The rachis is of medium length, the raceme cylindrical, medium compact. The colour of the corolla ranges from light violet to dark lilac, but dark violet shade prevails.

Economic features: Less susceptible to lodging, of a fine type, readily tillering, of closed stand. As a result of its favourable leaf to stem ratio, high dry matter and protein content it is of a good fodder value. In the spring and after cuts is medium sprouting, mid-early variety of long life-span, resistant to frost, winterhardly, resisting even to late spring frosts of -6 , -8 °C. Its resistance to drought and heat is moderate. Its fertility comes into full display mainly in areas richer in precipitation or irrigated, with lower mean summer temperatures and after proper fertilizer application. Its seed setting capacity in Hungary is satisfactory. Medium resistant to leaf diseases, to the most frequent leaf spot *Pseudopeziza medicaginis* (Lib./Sacc.) 25 per cent more resistant than the old Hungarian lucerne varieties. Substantially more resistant to the nematode damaging lucerne (*Ditylenchus dipsaci* [Kuhn] Filipjev) than the other Central-European varieties.

Growing region: The areas of Central and Eastern Europe not deficient in precipitation. The areas of the north-western part of Europe where the longer (four year) life span is a favourable economic feature.

DERIVATIVE SPECTRA OF NORMAL AND MUTANT MAIZE LEAVES

It is known that photosynthetic pigments are found in chloroplasts in physical states differing from the classical solutions: they form aggregates of different sizes and shapes as well as bond with proteins and lipids. Consequently the absorption maxima of pigments in vivo shift towards the longer wave-lengths (LITVIN—RIHIREVA 1962).

The shift from the absorption maximum characteristic of the solution (FRENCH 1960) is approximately 20 m μ for β carotene, 5 m μ for chlorophyll b and 5–20 m μ for chlorophyll a.

The transfer of energy between the various pigment fractions and the chlorophyll "a" forms directly acting in photosynthesis is possible.

Thus the energy range of light utilizable by the plants significantly increases.

Active chlorophyll "a" has two main forms: one system absorbing at relatively shorter and another absorbing at longer wave-lengths; these complete the different steps of the primary quantum conversion (CALVIN—ANDROES 1963).

The quantity of these different components of the photosynthetic apparatus changes with variety, age and environmental circumstances; a definite proportion of them is necessary for the undisturbed functioning of photosynthesis (ALLEN—FRENCH—BROWN 1960).

The comparison of the *in vivo* spectrum of chloroplast mutant leaves with different photosynthetic activities provides a good opportunity for studying the functional significance of these relationships.

For our studies we grew normal, lycopenic and ζ carotenic seedlings for 8 days at 25 °C with light intensities of 5, 10, 25 and 50 lux. Our light source was a tungsten lamp. The extreme

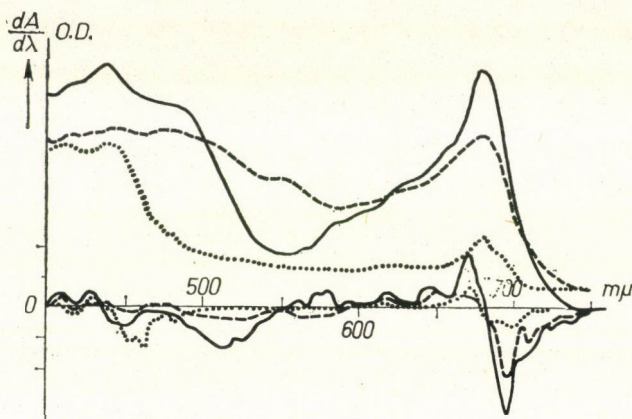


Fig. 1. The absorption spectrum of normal and mutant leaves (grown at 10 lux)
 — normal, — — lycopenic, . . . ζ carotenic

light sensitivity of the mutants necessitated this low light intensity (FALUDI—DÁNIEL—LÁNG 1965). The *in vivo* spectrum of the mesophyll of the leaves was measured with the "opal glass" method of SHIBATA (SHIBATA 1958) and with a UNICAM SP-800 spectrophotometer. We noted the absorption values at intervals of 5 m μ and formed the first derivative of the curve between 650 m μ —750 m μ as a function of the wave lengths (BELL 1965).

The pigment content of the leaves was determined — after methanol extraction (OGAWA—SHIBATA 1965). — by the OGAWA—SHIBATA method.

Fig. 1 shows the derivative of the *in vivo* absorption spectrum of the normal, lycopenic and ζ carotenic leaves falling within the visible wave range.

The figure shows that the short wavelength portion of the spectrum clearly reflects the differences of the carotenoid composition. In the red spectral zone differences between the normal and mutant leaves are shown in their absorption maxima and in the line of their curves. The chlorophyll "a" forms of normal and mutant leaves grown at different light intensities are introduced in the derivative spectra given in Fig. 2.

The figure shows that in normal leaves the separation of the different fractions becomes more expressed with the increase of light intensity. On the basis of the minima of the curve or rather on the basis of the intersection with the 0 axis we can conclude one big and two smaller components in the 5 lux normal leaves. In 10 and 25 lux leaves there are three in addition to the main maximum and in case of the 50 lux leaves four smaller fractions are distinguishable.

The spectrum of lycopenic leaves does not essentially differ from the normal, while the relative number of chlorophyll "a" forms does.

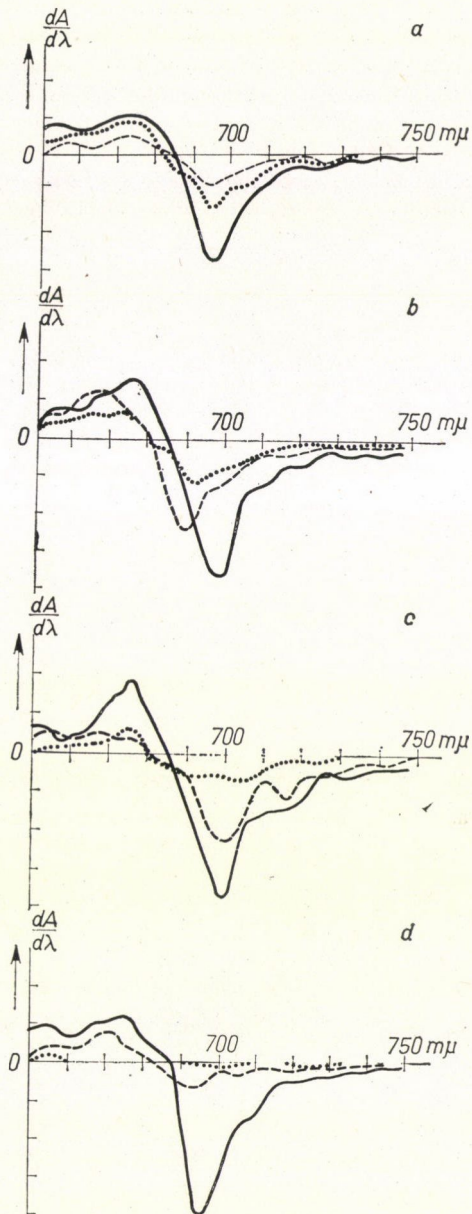


Fig. 2. The derivative spectra of chlorophyll "a" forms in the normal and mutant leaves grown at different light intensities

----- normal, — — — lycopenic, ... ζ carotenic
 a = 5 lux; b = 10 lux; c = 25 lux; d = 50 lux

Among the ζ carotenic leaves those grown at 5 and 10 lux contain the most chlorophyll "a" forms while those at 25 lux contain less and at 50 lux there are signs of great photodestruction. According to BRODY—BRODY (1963) in case of identical types of supporting surfaces there is a correlation between the location of absorption or emission maxima and chlorophyll concentration. In Table 1 we have compared the chlorophyll "a" concentration of leaves and the arrangement of the maximum of the chlorophyll "a" component showing the greatest absorption in the normal and mutant maize leaves.

The data of the Table show that in normal leaves the concentration of chlorophyll "a" increases — as it was expected — parallel with light intensity. In the lycopenic leaves the values are for the most part unchanged. In the ζ carotenic mutants chlorophyll "a" content is explicitly reduced under the effect of greater light intensity. In analyzing the intensity of absorp-

Table 1

Chlorophyll „a” concentration and the in vivo absorption spectrum of normal and mutant leaves grown at different light intensities

Concentration [10^{-9} M/g fr. s.], λ [$m\mu$]

Material	5 lux		10 lux		25 lux		50 lux	
	conc.	λ max	conc.	λ max	conc.	λ max	conc.	λ max.
normal	501	683	683	684	833	684	886	685
lycopenic	79	682	64	680	58	680	53	680
ζ carotenic	141	681	24	680	21	678	6	—

tion maxima it has been discovered that the normal leaves show a shift towards the longer wave — lengths parallel with an increase in light intensity. The figures for the lycopenic leaves remain more or less on an identical level while those of ζ carotenic leaves show a tendency to decrease.

The wave length differences are, however, not great especially if we consider that in the red spectrum the spectral slit width is great but the values are well reproducible. The validity of the maxima is supported by the fact that two to three positive or negative points determine the point of intersection of the derivative curves with the 0 axis.

Accordingly, wave-length differences can be considered as a definite tendency.

If the trend of the change is concerned it is possible to find a relation between the shifts of absorption maxima and pigment concentration, but this is not as proportional as that described in case of *Euglena*.

Similar minor shifts were experienced by HABERMANN (1960) in *Helianthus* which is capable of xanthophyll synthesis, contains no carotene and its chlorophyll concentration — among the environmental conditions of the greenhouse — is 8–10% of the normal value.

SMITH et al (1959) found similar differences in the etiolated leaves of normal and mutant maize strains following a short period of illumination. The deviations between the absorption maxima are supported by the differences shown in fluorescent spectra and in the stability of the pigment-protein complex (FALUDI—DANIEL—LÁNG 1965).

In conclusion we may state that the in vivo absorption spectra of normal, lycopenic and ζ carotenic leaves show the physical states of the chlorophyll "a" component to be different in them. This might be related to the reduced photosynthetic activity and the increased photolability of the mutant.

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ÁGNES NAGY

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FIRST DATA ON FODDER SORGHUM GROWN IN HUNGARY

The acclimatization of fodder sorghum — taken in the modern sense of word, — is undoubtedly connected with one name: that of the recently deceased JÁNOS SURÁNYI. He was who has brought seed samples to this country from the first decade of our century in order to have them tested. As early as in 1914 he reports on the first grain sorghum varieties called: “Milo, kafir and durra”. In the twenties he started intensive experimental and acclimatizing work with Sudan grass. After 1930 he found, among the sugar sorghums, the first variety being suitable for acclimatization: the Sumac-varieties. And then, in the forties he began to propagate the Early Hegari grain sorghum.

Apart from the broomcorn (*Sorghum vulgare technicum*) which, according to our best knowledge, has been grown in Hungary for centuries, — there had been carried out cultivation experiments with fodder sorghum, too, before the times of SURÁNYI.

The earliest data known so far referring to sorghum growing was the article by KOSUTÁNY published in 1884 (BARABÁS 1954). In this he reports on the cultivation of the variants "Imphy" and "Kao-lien" in the years around 1860 and even before that time. From this the conclusion could be drawn that the first attempts in this country were made with fodder sorghums that had been taken from Africa to the USA and then from there back to Europe.

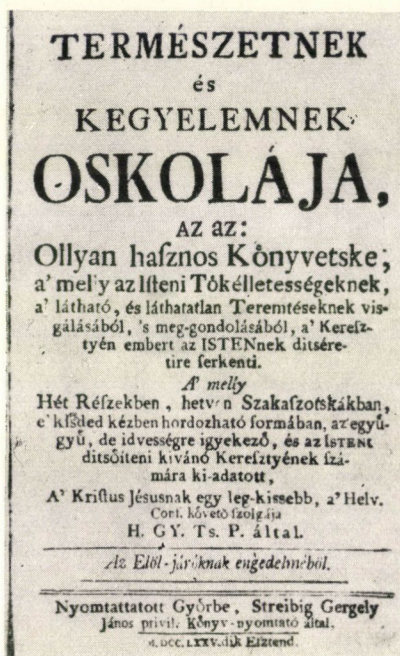


Fig. 1. "The School of Nature and of Grace" title-page

However, the most recent data contradict this hypothesis. It seems that the cultivation of fodder sorghum in Europe and also in this country had considerably preceded the first American attempts (1854).

Recently, when studying old medical books, we came across much earlier data that have been unknown so far.

The author using the initials "H. G. Y. Ts. P" in his book published in 1775 under the title: "The School of Nature and of Grace", refers to sorghum growing and to the importance of its "lodging-resistance" as it is called by modern terminology. What he says is literally the following: "The best-known crops in our eyes are wheat, rye, barley, millet, German wheat (*Triticum spelta* L.), sorghum, buckwheat, etc." "The length of these grasses is made up by certain internods, some consist of more, some of less internods so as to be stronger and not be broken easily by wind or some other force, and should they break, from the lower internods new stalks might develop."

The value of these data lies in the fact that he finds it natural to range sorghum among the 6 grain crops. The remark renders it very likely that authors have meant graincrop by this term, too.

Much more interesting than this indirect proof is the description of JÓZSEF CSAPÓ in his book "New Hungarian Grass- and Flower Garden" being also published in 1775 (with the types

of the printer Landerer, the printer who had such important part later in the Buda-Pest Revolution of 1848). From this book it becomes undoubtedly evident that even previous to the publication of this book there had existed *grain sorghum* growing in Hungary. That detailed and botanically modern description — taking into consideration the time of publication, — writing of “sorghum millet” and “Indian millet”, leaves no doubt as regards the type and way of utilization. The text runs as follows: “(Archaic Hungarian names for grain sorghum: „Czirók, Czilköles, Czirköles”). Latin: *Sorgum*, *Milium Indicum*, *Milium arundinaceum semine subrotundo nigricante* C. Baupini pin. 26. French: Millet d’Inde, Ble’ Barbu, Sorchi. Italian: Sorgo. German: Sorgzaamen Indianischer oder Welscher Hirsch.

It grows tall like reed having the same hard stalk. The heads yield flat angular seeds being but slightly bigger than those of millet. This plant had first been brought from India to Italy whence it has spread all over Europe. In the County of Győr I have cultivated it myself”.

Our supposition that the sorghum in question is fodder sorghum, is confirmed by the part “General use”, running as follows: “1./ When being ground i.e. milled, flour is produced from it, however, the bread baked from that flour falls to crumbs, it could be amended by adding barley flour. 2./ Hens and pigeons can be fed on it.”

We should like to mention, as a matter of curiosity, the paragraph “Inner Application and Use” being among others, prescription of recipes: 1./ The broken seeds when boiled heal gonorrhea (whites) both of man and woman. 2./ The broken seeds when mixed with egg-white stop diarrhoea.”

The suggestion of healing the “whites” (*gonorrhea*) is, of course, more than an outworn conception. The second suggestion, however, agrees in some respect with our present concept. Viz., the powder of seeds grown in those days and being of tannin content, might show inhibiting effect of diarrhoea.

On the basis of these data learned recently, we might say that fodder sorghums (*Sorghum vulgare*) were grown as grain crop in Europe and in Hungary, too, as early as the 18th century.

Z. BARABÁS, Z. BARABÁS (JR.)

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ON THE AUTHOR OF THE BOOK “THE SCHOOL OF NATURE AND OF GRACE”

As proved by bibliographic investigations in the XIXth century, the book has been written by GYÖRGY PÁLÓCZI HORVÁTH the Minister of Reformed Church who was pastor in the village Császárs of the Transdanubian County: Komárom, after 1761.

The earliest known data of the author’s biography lead us to Debrecen where he was studying in the famous Calvinist (reformed) College from 1747. After having finished his studies

in 1752/53 he became rector first in *Büdszentmihály* and then in *Törökszentmiklós* being head teacher of the schools there. That data show what developed high-school education could be found as early as the XVIIIth century in *Debrecen*; with some local patriotism, that town used to be called the "Calvinist Rome". After having gained the gown, the students — before getting to a parish or obtaining a job as assistant minister, — had to become rector in a village which meant a job not only at school but also that of parish Choir master.



Fig. 1. "The School of Nature and of Grace" on page of the book

Büdszentmihály just as well as *Törökszentmiklós* are, in the Great Hungarian Plain, borough settlements east of the river Tisza being of so-called "*puszta*" character, while the villages of the County *Komárom* are situated in hilly regions at the foot of the mountains: the Transdanubian *Vértes*, *Pilis* and *Gerecse*, in the valleys of smaller rivers and brooks falling into the Danube. Viz., — Gy. Pálóczi Horváth was — as early as 1760 preacher in *Dunakömlőd* belonging to the church district *Tata* in the County *Komárom*.

As could be seen from the preliminaries, the book mentioned: "The School of Nature and of Grace", appeared under the pen- name H. Gy. Ts. P. in *Győr* first in the year 1765, then in the years 1775 and 1778. Thus, the book was issued three times, however, in official circles it was not known, for quite a long time, who was hiding behind this so-called polygram. Both in Hungarian and in English polygrams are called those concealed names (*cryptonyms*) in which not 1—2 letters of the author's name (*monogram*) but more letters or groups of letters stand for the pseudonyme.

In Hungary during the reign of Maria Theresia no protestant preacher could have been named as the writer of such free-thinking book as that in question. And especially Pálóczi Horváth's book couldn't have been published without consequences in *Győr* at that Catholic Episcopal Seat, in a town with historical past sited where previously the Roman *Arrabona* and later the baroque *Raab* had been. Though the Austrian Empress who was at the same time

Queen of Hungary, made efforts to decrease the horrible burdens of the serfs and therefore tried to restrict the privileges and despotism of the squires restoring the villeins' right for the free change of residence that they had been deprived of in 1514; she put an end to the squires having their own courts (manorial courts), diminished duty labour, — however, owing to the opposition, of the Hungarian Feudal Diet, she could not lessen essentially the villeins burdens. Whereas together with her son and successor from 1780, Joseph II. she extended also to Hungary the German reforms of public education.

The notorious decree of Maria Theresia called "*Ratio Educationis*" served the purpose of entire Germanizing in Austria, a country with mixed national minorities, and it was not until 1781 that serfdom had been abolished and protestants as well as Jews endowed with equal civic rights.

Under such political and cultural conditions Gy. Pálóczi Horváth could not write freely, only as: H.[orváth] Gy.[örgy] Ts.[ászári] P.[raedicator]. In order to solve that polygram it is to be explained that it was not until the thirties of the XIXth century that the official regulations of orthography were published on the initiative of the "Hungarian Scientific Society", the Academy that had been brought into existence in 1830. Up to that time the Hungarian sounds "ts" and "cs" though pronounced in the same way, had been written differently in certain regions and printing houses according to what was accepted as orthography of a grammatical school by a town (in *Pozsony, Pest, Debrecen, Kolozsvár* or *Győr*). Therefore the archaic "ts" being yet valid in *Győr*, and the compound consonant "cs" of the modern orthography being already used elsewhere, have meant in the abbreviation "Ts[ászár]" the village *Császár* in the County *Komárom* in those days as well as in the present.

This polygram was solved by bibliographers as early as the end of the previous century, viz., Gy. Pálóczi Horváth had been not only the protestant pastor of the village *Tsászár* (*Császár*), but also the notary of the *Tata* (*Totis*) Reformed Church District from 1761 to 1787. The author's very important church historical recordings referring to these years have survived just as well as his secular and religious poems and carols. Gy. Pálóczi Horváth died in 1788. His name, even though being kept in secret, had been made famous not only by his successful book mentioned previously, but also by his son, the polyhistor writer, poet and folklorist of the age of Hungarian enlightenment: Ádám Pálóczi Horváth.

Monographs and treatments in the Hungarian history of literature have revealed almost every little detail of his life, however, the agricultural character of our review does not allow to submit for our readers, more detailed information on the subject; we therefore refer to some important inferences only.

In the year when the King of England George II died and his grandson the 22 year old George III commenced his glorious reign, — was born in 1760 the son called Ádám of H. Gy. Ts. P. The parish of the priest-father and the birthplace of the son are the same: *Duna-kömlöd* in the County *Komárom*. As already mentioned, the author of "The School of Nature and of Grace" had been, since 1761, the pastor and church district notary in the village *Császár*. Most probably, it was in these years that the book was written and the son who was later to become a poet, lived his childhood.

Ádám Pálóczi Horváth must have become of school age around 1766, — after the first publication of the book. The pastor let his son to be taught in the *Császár* village-school which, in those days, could be but of lower grade because the child frequented higher classes in the neighbouring villages *Bicske* (in earlier orthographay: *Bitske*) and in *Kocs* (earlier: *Kots*).

And yet, it was not by the family name Pálóczi Horváth that the latter little village had been rendered world-famous, but by a great Hungarian historian: Dániel Cornides who lived in *Pozsony* (*Bratislava, Pressburg*). It was in 1781 that he published in the first volume of the quarterly "*Ungarisches Magazin*" appearing in *Pozsony* and being written in German language, his important scientific results on the identity of the words being in Hunga-

rian "kocsi" (or *kotsi*), in Italian "Cocchio", in French "Coche", in German "Kutsche", in Slavic "Koč, Koči" etc. and in English "coach", and on the origin of coaching in Hungary.

The special character of our paper renders it possible to revert to the agrarian relations of that problem discussing it later in details.

Gy. Pálóczi Horváth made his son, after having finished the primary school-years in *Kocs* (or *Kots*), enter the *Debrecen* Calvinist (reformed) College in 1773, the same old *Scola* that he himself had frequented in about 1740. Just at that time István Hatvani happened to teach at that College and became famous as a learned professor, "the Hungarian Faust", through his research work in natural sciences of progressive character. By doing so, he challenged the grudge of the Board of Teachers and that of the Church Magistrate. The young Ádám Pálóczi Horváth became a pupil of I. Hatvani and he himself got into conflict with the Magistracy of the College. After having finished his philosophical studies, he did not become a theologian, instead he went in for law and later on, with the assistance of Prof. Hatvani, he took his engineer's degree. Then he returned to his Transdanubian home and got settled in the town *Pápa* in the capacity of engineer.

In 1782 after Emperor Joseph II had liquidated the majority of the monastic orders and had most of the monasteries closed, leasing their estates, Ádám Pálóczi Horváth became the tenant of the Treasury Land Management that had been made from the Benedictine Abbey Lands in *Tihany*. From this time on, he used to live partly in *Balatonfüred*, partly south from the Lake *Balaton*, in the village *Szántód* as tenant of the treasury large estate in the life of Emperor Joseph II until, under the influence of the outbreak of the great French revolution or that of the fall of his brother-in-law Louis XVI, the latter cancelled his decrees.

By this time the author of the book "The School of Nature and of Grace", Gy. Pálóczi Horváth was dead. And his son after being dismissed from the estates of the *Tihany* Abbey lands and being left without means, retired to his small estate in the County *Somogy* devoting himself to literature only.

As a poet he made his great epos called *Hunnias* or *Hungarian Hunyadi*, appear written in the style of Vergilius Aeneas, one year after, on the occasion of his father's death, he wrote and published a philosophical essay on the "Soul's immortality".

Like his great contemporaries, he too, dealt with almost every branch of science, his book "Psychologia" written in 1789 could appear only in 1792. His astronomic work "The shortest summer night" left the press in the previous year, in 1791.

His great idea to publish a Hungarian Universal Encyclopaedia could not be realized in the times of Absolutism. During the Napoleonic wars he lived in retirement being in friendship and corresponding with the great literary and scientific men of that time, P. Ányos, J. Földi, M. Csokonai Vitéz and the Jacobin, ex-convict F. Kazinczy. One of his last works was a little manual on the Statistics in Hungary that was published after the Viennese Congress under the control of the restored imperial censorship, in 1817.

The son of Gy. Pálóczi Horváth, too, was engaged in collecting and composing lay songs finishing his unparalleled compilation of folksongs in 1813, being called "*Ötödfélszáz Énekek*" (Five and a Half Hundred Songs). Of this work the manuscript had survived and appeared only 140 later in the philological edition of the Publishing House of the Acad. of Sci. in Budapest, in 1953.

The period of the Holy Alliance was no more the world of people like Pálóczi Horváth, and just as all over Europe, lead by the Prince of Clement Metternich or Sir Arthur Wellesley, the Duke of Wellington, — in Hungary as well the Ancien Régime gained the upper hand.

Ádám Pálóczi Horváth, the son of the author of the book: "The School of Nature and of Grace", died on the 28th January 1820, one day before the death of George III, King of England.

Were our periodical review not be written in English, the tragical analogy would not have been mentioned.

Gy. SZAMOS

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THE QUANTITATIVE CHANGES OF ASCORBIC ACID DURING THE GROWTH OF THE *ARANYESŐ* BEAN VARIETY

Ascorbic acid plays an important role in the growth and development of plants. The ascorbic acid content of plants is closely related to the different stages of growth and development. Our studies have been carried out on the *Aranyeső* bean variety. We have closely observed the changes in the reduced ascorbic acid content from sprouting until the appearance of the fifth node. Since the oxidized form has a more labile character, the reduced form is a better index of growth and development.

Similar tests were carried out by PÉTERFY—BRUCOVITZKY (1959) on *Immerso* and *Cerasiforme* tomato varieties and on *Physalis alkekengi*, *R. canina* var. *lutetiana*, *R. rugosa* and *R. pendulina*. According to the study the accumulation of ascorbic acid reaches its peak in the leaves at blossoming and its nadir at fertilization.

During our experiment we noted that the amount of ascorbic acid gradually increased from the time of sprouting until the appearance of the first node. Daily measurements were taken until the appearance of the first leaf row. The ascorbic acid content of the root and stem

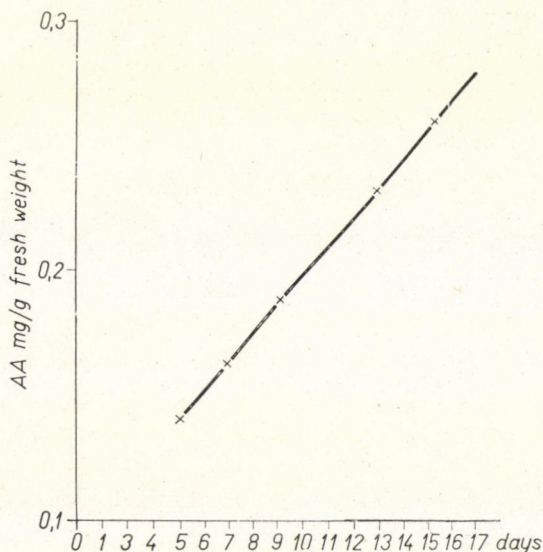


Fig. 1. The changes in ascorbic acid content during the first 16 days in the growth of seedlings

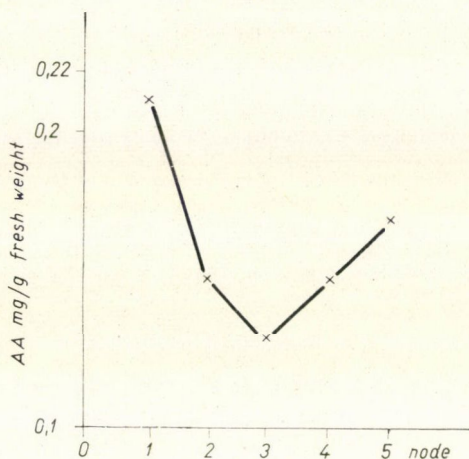


Fig. 2. Changes in the ascorbic acid content in the first to fifth node

increased until the ninth day and afterwards the leaves showed similar changes. After the appearance of the leaves the ascorbic acid content of the stem and root was reduced. From the 13th day we even noted reductions in the leaves. This is mainly due to the circumstance that the highest ascorbic acid content may be found in young leaves and in the stem at its apex (VALENTA—KUTACEK 1960). Later, tests were carried out according to leaf-rows; the ascorbic acid content of the root, stalk and leaves were separately determined. The experimental results may be seen in figures 1 and 2. The figures present the changes of ascorbic acid content in mg/g fresh weight calculated as a function of time or leaf row.

It may be clearly seen from the figures that there is a reduction in the total amount of ascorbic acid found in the second and third leaf rows. This may be attributed to the intensive growth of the bean plant in this period. This growth may be seen in the distribution of ascorbic acid in such a way that the ascorbic acid content of the stem and root significantly increases in relation to the values measured for the first leaf row, while the ascorbic acid content of the leaves reduces. Since the total ascorbic acid content of the root and stem does not equal the content of the leaves even this way, it is comprehensible that the ascorbic acid content of the entire plant is reduced. The bean plant stops growing after the fourth node and the ascorbic acid content of the leaf and the total ascorbic acid content again increases.

These tests were made on plants grown in full illumination and thus we could examine the influence of ascorbic acid content on growth only. Later similar examinations were made on beans grown in darkness. Our experiments indicated that the ascorbic acid content of beans kept in darkness did not increase, but rather decreased. This is due to the lack of chlorophyll. Thus, in addition to growth, light is the second decisive factor for the distribution of ascorbic acid content. The concluding part of our examinations comprised the determination of the dry-matter content. Our results have led us to the conclusion that there is a positive correlation between ascorbic acid content and dry-matter content of the plant: the higher the ascorbic acid content of the organs, the greater will be the dry-matter content.

The determination of ascorbic acid content has been done with chemical methods (STRAUB 1965), with indophenol titration.

*

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INTERNATIONAL SYMPOSIUM ON MEDICINAL HERBS*

Budapest, September 20—25, 1965.

An international symposium on medicinal herbs was held in Budapest between September 20 and 25th in order to celebrate the 50th Anniversary of the Institute for Research on Medicinal Herbs. The Institute as well as other interested authorities, companies, research and educational centres participated in the programme.

The successful symposium was held in the assembly hall of the Hungarian Academy of Sciences.

The inaugural address was given by G. Soós, deputy minister and then P. TÉTÉNYI, director, greeted the participants. Afterwards he gave a comprehensive lecture on the half century of experimental activity of the Institute for Research on Medicinal Herbs.

In three days 250 participants from 15 countries attended 67 lectures prepared by 108 authors. The lectures were given in French, German, Russian and Hungarian.

The subject matter of the symposium covered a very broad range of questions related to medicinal herbs.

A few speakers reported on the major results, trends and future perspectives of research in the well-known institutions of their countries. This is how the audience got a comprehensive picture of the work of VILÁR from the lecture of P. T. KONDRATYENKO and I. A. GUBANOV (Moscow), of the status of breeding medicinal herbs in Czechoslovakia from F. STARY (Prague) and of the results of the KOMAROV Institute of Botany from V. S. SOKOLOV (Leningrad).

Nine lectures treated the extremely important question of breeding. Thus, for instance, P. TÉTÉNYI (Budapest), M. STEIN (Quedlinburg) and F. STARY (Prague) familiarized the audience with the present status of medicinal herb breeding, and P. TÉTÉNYI (Budapest) gave a general survey of the methods of breeding medicinal herbs. In addition to these reports were given on the concrete results of the different methods of breeding a few medicinal herbs important for the pharmaceutical industry, i.e., mainly the poppy H. BÖHM (Halle) S. MÓRÁSZ (*Kompolt*), K. LÖRINZ—P. TÉTÉNYI (Budapest). The speakers paid special attention to the biochemical aspects of the question, i.e., to the necessary changes occurring in the chemical composition of the plants. The use of the concept of chemical races was repeatedly suggested in relation to the topic.

About 4 or 5 lectures were given on the problems of chemotaxonomy: V. HEROUT (Prague) presented data on the chemical features of different families (e.g., *Compositae*) while A. L. HRIMLJAN (Yerevan) and H. SCHILCHER (Munich) described the chemotaxonomically different species (mint, *solidago*).

The 14 lectures concerning the pertinent agrotechnical tasks involved in the commercial growing of herbs were of special interest. Four talks treated the problems and results of using

* Hungarian title: Nemzetközi Gyógynövény Symposium.

chemical weed killers on medicinal herbs and plants yielding volatile oils and the affect of individual compounds on the active ingredients of herbs. Briefly they treated the possibilities of chemical weed killing during the growing of volatile oil yielding plants (J. SVÁB—D. FÖLDESI (Budapest), A. RUMINSKA (Warsaw), K. MICHAL—G. VRANY (Prague), H. ZAHN (Artern),

M. MÜLLENBERG (Leipzig) reported on an interesting experimental project which has been in progress for six years. The affect of different amounts and mixtures of artificial fertilizer on the yield and quality of fennel (*Foeniculum vulgare*, Mill.) was analyzed.

M. BÉKÉSY—L. TRÉFÁS—F. NAGY (Budapest), A. SMOLYANOV (Simferopol), F. EISENHUTH (Leipzig) and others lectured on the results and possibilities of mechanization in the production of plants important for the pharmaceutical industry.

The ecological factors of the various growing sites have a complex affect on — and thus play an important role in — developing the proper qualities and quantities of active plant ingredients. In his lecture J. TUCAKOV (*Belgrade*) emphasized the need for the international study of growing medicinal herbs on a large scale. Other speakers described their studies of the fluctuations of the quantity of active ingredients in a particular plant in order to discover the affect of sunlight, illumination, drought or other factors L. COSSON (Paris), E. NICHIFORESCU—V. CUCU (Bucharest), S. IVÁNYI (Budapest).

The fluctuations of active ingredients due to growing period and time of day have to be considered whenever examining the ecological factors as well as the quality and quantity of the active ingredients. This question was thoroughly treated by V. M. SRYKOV and B. G. CHINGOVA (Kazanlik) in their lecture on the dynamics of collecting volatile oils from lavender blossoms and by other speakers too.

The lectures treating the various questions of the active ingredients of plants comprised a very important part of the scientific programme of the symposium.

A few speakers reported on the isolation of new active ingredients [F. SANDBERG (Stockholm), etc.]. And several reports the problems of the analytics of medicinal herbs either generally treated or applied it concretely to one plant or active ingredient or to one group of active ingredients E. TYIHÁK—G. GULYÁS—K. JUHÁSZ (*Budapest*), K. JOVÁNOVICS (Budapest). The chromatographical and especially the thin-layer chromatographical methods are important analytical solutions. I. BAYER (Budapest) presented a comprehensive survey of the thin-layer chromatographical analysis of alkaloids.

The reports on experiments in extracting a few active ingredients of industrial importance (alkaloids, solasodin, etc.) created great interest P. BITE—E. M. KARÁCSONY—T. RETEGI—A. USKERT (*Budapest*), B. ZSADON (Budapest).

Cs. LŐRINCZ (Budapest) discussed about the affect of the distribution of organic bases, mainly alkaloids, in a liquid—liquid system and presented experimental results which contradict the usual experiences, proving that with the aid of certain acids the mentioned active ingredients can be directly and fully brought into an organic phase. Further study of this problem may lead to and analytical and industrial quick method.

Six lectures presented problems of the biogenesis of plant active ingredients and the current results of studies on new and difficult questions S. SÁRKÁNY—G. V. PETRI—K. M. NYOMÁRKAY—I. S. KISS (Budapest) examined the alkaloid formation of *Papaver somniferum* L. in relation to tissue structure and organ differentiation. K. B. HORVÁTH—M. V. BALÁZS—O. CLAUDER (Budapest) presented data on the biogenesis of the pyridokantin structured alkaloids of *Vinca minor* L.

The programme was completed by lectures on the results of medicinal herb research from a pharmacological aspect. One of the most modern tasks of medicine is to find medicines to effectively cure cancer and arteriosclerosis etc. Intensive research is continuing in this field too. Four lectures were given on the results of such research: I. PÁLYI—E. TYIHÁK—V. PÁLYI (Budapest), V. M. BANDHIKOV—M. N. KONOVALOV (Moscow).

The audience paying great attention to the lectures had a number of questions and contributions.

P. TETÉNYI closed the programme by briefly summarizing the work of the symposium and emphasizing the need for such meetings to debate problems and report on results.

The lectures given during the International Symposium on Medicinal Herbs will be published in a special issue of *Herba Hungarica*.

Besides the scientific programme, a social evening, opera performance a visit to the Institute for Research on Medicinal Herbs and a two-day study tour of the medicinal herb farms near the lake Balaton, have given variety to the program of the Symposium.

ÁGNES KÉRY

INVESTIGATION OF THE VASCULAR BUNDLE SYSTEM OF THE FLOWER WITH THE "CLEARING" METHOD

All over the world a number of research workers are engaged in investigating the reproductive organs from morphological, histological, histogenetical etc. aspects. (D. JUHÁSZ 1964/a).

Part of the studies connected with flower and fruit are in relationship with the often discussed problem of the formation of the inferior pistil (receptacular, — appendicular theory). Also in the latter examinations a complete and thorough knowledge of the vascular tissue system is essential which can be traced on the serial cross and longitudinal sections. The preceding microtechnical works are, however, rather time consuming and reconstruction of the vascular tissue system is only possible after detailed studies of sections.

In the course of my examinations which were directed mainly to *Cornus* species, to become more rapidly acquainted with the network of bundles I made an attempt with the "clearing" method (Bozó 1936, Rom 1934). For this purpose I used partly freshly collected partly fixed buds of various developmental stages, open and postfloral flowers.

Clearing as a method has been known for a considerable time and has had an important role in the identification of petals, particularly of the leaf-drugs (SÁRKÁNY—FILLÓ 1951, MAGYAR GYÓGYSZERKÖNYV — Hungarian Pharmacopoeia 1954). The point is to extract the protoplasmatic substance of the cells with various chemical treatments without deformation of the cellwalls (SÁRKÁNY—SZALAI 1964).

In the following the cleared flower was treated with toluidine blue as a well known metachromatic stain (SÁRKÁNY 1941). Hereby the whole bundle system became visible and its position in the space, connections etc, could be readily studied (Figs. 1, 2, 3, 7). Beside the bundle network of course also the other parts of the flower can be observed.

From the objectives of examination e.g. in the species *Cornus sanguinea* L. and *Cornus mas* L. in the level above the ovules the cross bundle ring (Figs. 3, 4) that appeared in the course of clearing is hardly perceptible on the serial sections. (Figs. 5, 6) Thus its exact position and role depending on the sections only can be hardly elucidated though for the estimation of the inferior pistil and interpreted as a "nodal level" it may have some importance (D. JUHÁSZ 1964 a, b). The clearing process was successfully employed also in the examination of flowers belonging to other families such as *Araliaceae*, *Cruciferae* (Fig. 2, 7) and it always readily supplemented knowledge gained on the grounds of serial sections.

*

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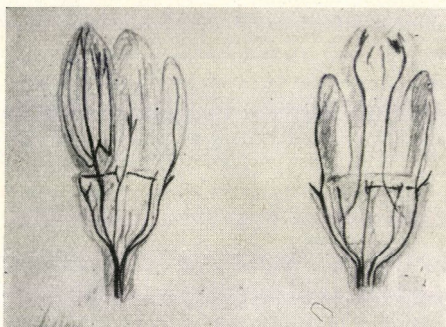


Fig. 1. Vascular bundle system of the cleared flower of *Cornus sanguinea*, schematic drawing.
Magnification: 63 ×

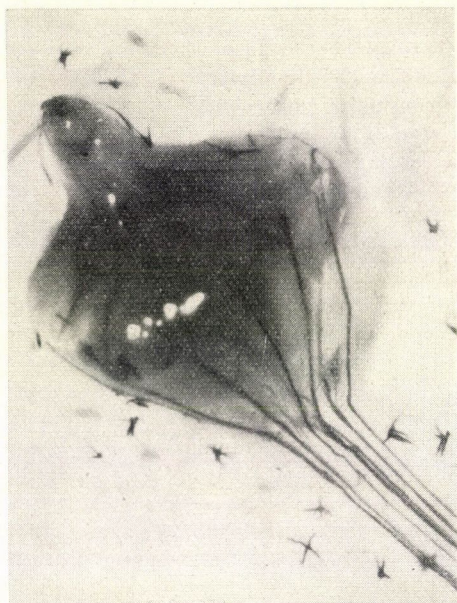


Fig. 2. Cleared gynoecium of *Hedera helix*.
Magnification 25 ×

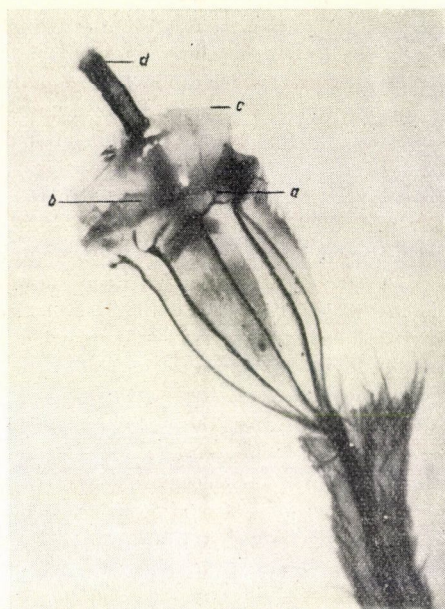


Fig. 3. Cleared gynoecium of *Cornus sanguinea*, stage after flowering. Magnification: 25 ×. a = cross bundle, b = sepal, c = discus, d = style

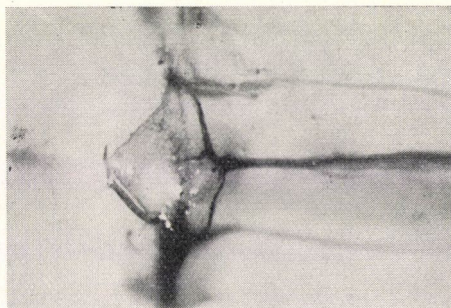


Fig. 4. Portion of cross bundle from the cleared flower of *Cornus* s. Magn. = 100 ×

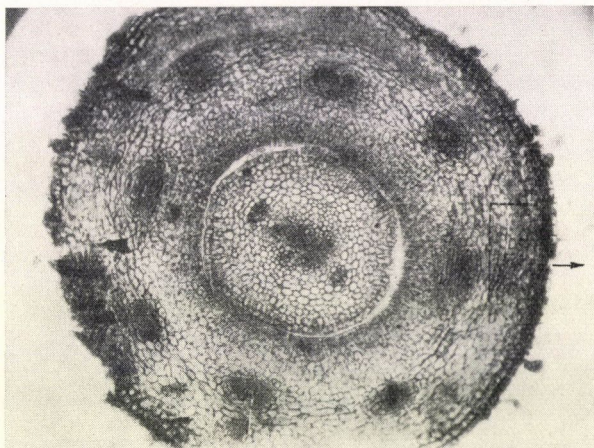


Fig. 5. Developed bud of *Cornus sanguinea* in the level above the ovules. Magnif. 40 ×

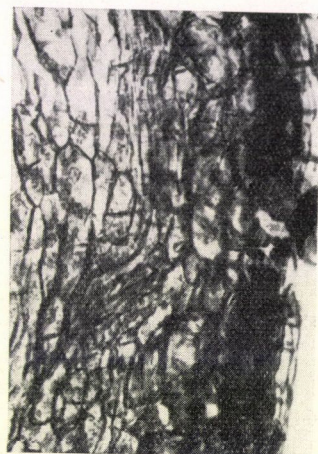


Fig. 6. Portion of cross section with cross bundle; *Cornus* s. Magnif. 80 ×

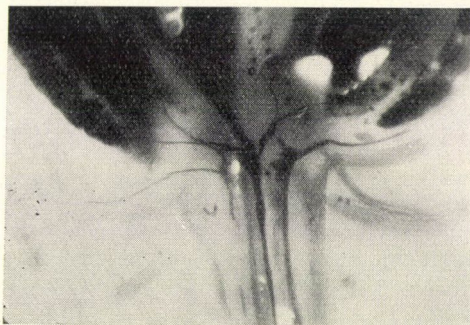


Fig. 7. Cleared hypogynous flower of *Sinapis arvensis*. Magnification 16 ×

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THE FIRST HUNGARIAN LITERARY REPORT ON THE AGRICULTURE OF ENGLAND

In our days when the Anglo—Hungarian political and cultural relations grow more and more marked, it seems to be timely to bring up the memory of the Hungarian traveller that first described and published in the *form of a book*, his observations made in England. The person in question is MÁRTON SZEPSI CSOMBOR, a young schoolmaster from Kassa who visited England in 1618 where, besides several important towns, he also studied London most thoroughly. Previously he had toured about in Poland, the Mazur-land and Prussia then, having crossed the Danish sea, he arrived in the Netherlands and taking a look round this country, he finally landed in England. He took in the landscape that unfolded itself before his keen eyes, and was so very different from that at home. With admiration he set fast that it was much more developed and prosperous than Hungary which had been ravaged in many a war by Turks and Germans and by internal troubles. Not only did he observe the world of aristocratic circles, that of the societies at court, — he did take interest in everything: economic and social manifestations. Being anxious to give a true picture of English conditions on the basis of his personal impressions he did not avoid the company of the simplest people either, — as he tells us in his report: *Europica varietas*. He formed his opinion on the nature and character of the Englishman, relying upon experiences gained from direct observation, while having a closer look at the industrial and agricultural conditions, too. The abundance of fruit roused his curiosity:

"That people — he wrote — is extravagant, weak and of feminine character. When I talked with a decent fellow about the fruit of England that man said that he had seen one piece of cherry being sold for sixtyfive pence which is equivalent to the same amount in Hungary. I seemed to have misunderstood him thinking he was speaking of some gem, and therefore I

asked what kind of a cherry he had meant. Upon which he answered that it had been like any cherry in any other country. Should I stay for two more weeks in that town, — he continued — I might see that a cherry or some other piece of fruit was sold even for as much as seventy pence because English people have a liking for early fruit paying for it high sums when they want to buy it for their sweetheart, master or for a good friend, while some people only hang the cherry on their ear lobes wearing it there as long as it has become common in the market doing so just in order to parade with the early fruit”.



Fig. 1. "Europica varietas" title-page

By this seemingly simple, childish story CSOMBOR characterized the world of English society in those days. After having visited the towns having but scarce population, he was surprised to see London with her several thousands of inhabitants. Being a man of practical common sense, he was immediately interested in what the consumption of such a metropolis could be. What quantities of the different kinds of meat were necessary to feed the town:

"There are so many people in Londinum that one might think: every day a fair is being held. I was told that besides the visitors of the town, three hundred thousand people live here permanently. Bread must be needed, I daresay! I can tell for sure that no week passes

without the slaughtering of one-and-a half hundred oxen and thousand sheep. Not to mention the birds and the masses of salt-water fish!"

The calculation is quite pertinent, — either had he got the data from competent authorities or whether he made calculations of his own. The cattle- and sheep breeding called to his attention particularly.

We are getting an illustrative picture on English animal breeding. He says that it was rather the size of the animal not their number which amazed him. The body of cows was as high and fat as that of any ox in Hungary, all the animals were black even if the hers consisted of as much as two thousand cows. Oxen were as heavy as buffalos at home. Their horns, together with the head, were as big as the lap of man and always white though the animals themselves were black. — Neither did he overlook sheep breeding. He noticed that wool was fine as pure silk. When looking for an explanation, he was told that in the meadows there is plenty of rosemary grass on which the sheep thrive, and it is this grass that makes wool nice and fine. CSOMBOR would not believe it as easily and wanted to find out the truth himself. When, however, he sniffed at the meat of slaughtered sheep, he could perceive the lovely smell of rosemary grass. "This grass — he adds as an explanation — is not identical with our rosemary which is also being raised in gardens just like in our country".

He was also surprised to find that the fields were enclosed by hedges. According to his statement, sufficient enough wheat, rye and barley were grown. In those days this was indeed the situation in England. Arable land is expensive — he says, — because "there are too many people for it".

Perhaps, because he himself was fairly mirthful and happy-go-lucky, he was especially interested in the world of London society this life being the result of economic welfare. He liked the parks and playgrounds. He gives a description of the sports of men: of long-jump, weight-throwing, games played with ball, throwing the spear, wrestling, game of skittles, trundling the hoop, etc. During his visit he could observe the famous *garden culture* in its brightest period, and he also noticed the *network of canals*. But let us see what he himself tells us all about it:

"To the left of those who enter, there is a house resembling a cathedral; in it you find diverse places in each of which some other game is played: ball, skittles, loop, marbles. And alongside you behold a lovely canal. Whence, if you go through the side-gate turning to the left and entering the *garden*, you will be surprised at its beauty and above all, at those you find therein: some throwing stones, some others poles; some wrestling or jumping while others, especially the young women-folk and delicate virgins, — take part in singing contests". Besides the gardens and canals he became aware of the high-levelled culture of society; this is proved by what he tells us about sports and singing. — To his record on the sporting spirit of English society he adds other data, too: young women were very fond of riding and it often occurred that some of them outdid their sweetheart. Evidently, this can be attributed to the flourishing horse breeding though MÁRTON CSOMBOR makes no mention of this in particular.

It is with enthusiasm that he observed the artificially shaped *fishpond*, and he registered that a special pond had been established for different fowls, with pelicans, sea ravens, swans etc. in it. Besides, the *deer park* is found. . . "and you might have a look into it from all sides". "You behold there much game: deer, white and black hare, wild oxen, roe, buffalo, and so on. Next to the garden there are the King's palaces. Some made of brick only, others of hewn stone. Every man has free entrance into the courtyards, nobody would ask him what he was doing there, what was the purpose of his coming?"

Thus he too, could go about freely, without any restriction and he *did* avail himself of the opportunity. He wanted to meet the king himself, however, in that he had no luck.

"I did my best to see King James but was told by his chief courtiers that for a fortnight he has never left his house and neither has anybody been allowed to enter his palace so great was the press of his work."

Though he did not succeed in seeing the king, he had good opportunity to view the houses, palaces and the walks bordered with *limetrees*, the *gardens* used for games which, as it seems, must have appealed to him very much, because he mentions them time and again. "These palaces are surrounded from all sides, with pleasuregardens, and in the town, too, there are promenades and parks with innumerable limetrees in such a measure that I hardly think any town of a country, besides Italy, were able to display the same lovely view". And here he ventures a quite amazing opinion: "Those who have ever seen in this town the king's gardens, palaces and the people at his court, will think but little of Germany's unpleasant music". The judgement of the Hungarian schoolmaster on contemporary English and German music is remarkably pertinent; we all know, and history of music has proved, that what he said is true. If we consider that in the course of their musico-pedagogic activities the followers of KODÁLY have often referred to English examples stating that the level of the music in English society was high in the past and so it is even today, — we cannot help appreciating CSOMBOR's opinion and so more so because it must have been based on everyday facts which he seems to have observed very thoroughly.

In the eyes of the XXth century these data on the agriculture of England in the XVIIth century might seem but few. For us, however, they are valuable because it was a young humanist who, in his wanderings through Europe, noticed the manifestations of the more developed English agriculture and social culture being related to one another and compared to the state of affairs in his own country. More than 200 years later ISTVÁN SZÉCHENYI and some of his contemporaries when taking a closer look at the English conditions had a more profound insight. However, among the foregoers the young schoolmaster SZEPSI CSOMBOR MÁRTON has a prior claim in appreciation in the history of Anglo-Hungarian relations.

R. SZIJ

REFERENCE

SZEPSI CZOMBOR, M. (1620): *Europica varietas, Festus János, Cassa.*

ACTIVITY OF THE PHOSPHATASE ENZYME IN IN-BRED MAIZE LINES AND IN PLANTS FROM SINGLE CROSSES

Several authors (SIKONA 1962, FIALOVA—DOBREMYSLOVA 1962, ROBERTS 1963) have treated the enzyme phosphatase which catalyzes the synthesis of glycose-1 phosphate from inorganic phosphate without the presence of energy-rich phosphate donors.

In our experiments we examined the phosphatase activity of maize plants of the C5, M14, O14, WF9 in-bred lines and in the C5 × WF9, C5 × WF9_{st}, M14 × O14 and WF9 × M14 single crosses.

Similar studies were carried out by HAGEMAN et al. (1962). The nitrate reductase activity was examined in the in-bred lines of maize and in the F₁ hybrids and it was found that the difference in nitrate reductase activity might be very great between certain lines and certain hybrids, or parental lines. The enzyme activity of the hybrids usually surpass that of the parental lines.

For the present study, examinations have been made on the leaves of maize plants, acid phosphatase activity was determined by the modified SOMMER (1955) method. The results

of this are given in Figure 1. The results of the relative activity was extrapolated to thirty minutes.

As we can see from Fig. 1, the phosphatase activity of the lines and single crosses — similarly to the data found in literature — moves between very broad limits. The lowest phosphatase activity is found in the C5 \times WF9 single cross and similar values are produced by the

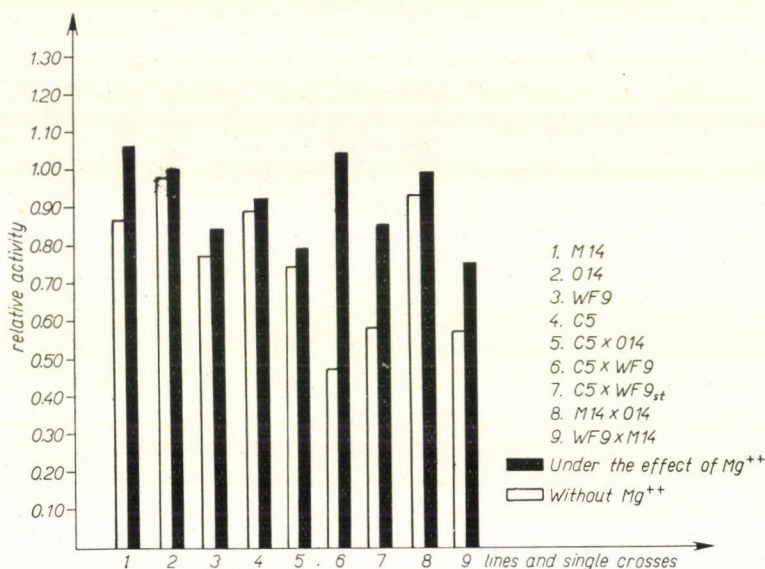


Fig. 1. The phosphatase activity of the maize lines and single crosses

WF9 \times M14 single cross for the C5 \times WF9_{st}. The greatest value for the hybrids was found in the M14 \times O14 single cross while the activity of the enzyme of the O14 line is greatest among those in-bred maize plants. The amount of enzymes found in C5 is similar to that of the M14 line.

After comparing the phosphatase activity of the in-bred lines and hybrids, it is possible to state that the hybrids contain a lower amount of enzymes than do the in-bred lines. The enzyme activity has increased after Mg⁺⁺ was added to the substrate, but even in this case greater values are produced by the in-bred lines. Among the hybrids the C5 \times WF9 single cross produced the greatest enzyme activity, while the WF9 \times M14 the least. Of the in-bred lines the greatest values were produced by the M14.

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MAGYARORSZÁG KULTÚRFLÓRÁJA

(Cultivated Plants of Hungary)

This serial work consists of 10 volumes being written under the auspices of the Agricultural Section of the Hungarian Academy of Sciences. General editors are: for the years 1959—1965 FERENC ERDEI and †SÁNDOR JÁVORKA, and from 1965: IMRE MÁTHÉ. Members of the editorial Committee: VILMOS FRENYÓ, ANDOR JÁNOSSY, ZOLTÁN KÁRPÁTI, JÁNOS LELLEY, IVÁN OKÁLYI, SÁNDOR SÁRKÁNY, ANDRÁS SOMOS, REZSŐ SOÓ, BÁLINT ZÓLYOMI. Technical editor: SZANISZLÓ PRISZTER. The chapters dealing with plants separately, are written by special experts, thus the team of contributors for the whole work numbers more than 100 collaborators.

The work "Cultivated Plants of Hungary" comprises the cultivated plants being grown and those that can be grown, in our country, belonging in a broader sense, to the notion "agricultural plants". Thus, species of agricultural and vegetable plants grown in the field, fruit varieties, the Cryptogamous and flowering industrial plants and medicinal herbs are discussed herein (on the other hand, ornamental plants, the cultivated woody varieties, those pertaining to the forestry, etc., are omitted). The information comprises the nomenclature of the species discussed, their systematic position, origin, area, the history of their cultivation, the geography of cultivation, external- and internal morphology, chemical composition, metabolism, the uptake of nutriment, the physiology of development and growth, the biology of flower and fruit, environmental factors (climatic, edaphic, biotic factors), causes of damage (parasites), heredity, breeding, the most important aspects of growing, economic significance, utilization, description of the species and finally, a compilation of the literature on the subject.

Even on a world scale, besides the Soviet work (of which, however, only some volumes have been published so far), there does not exist an undertaking of similar range that would submit such a manifold summary in the knowledge of the agricultural plants discussed. The plants are enlisted in systematic sequence in the volumes, however, the fascicles once being completed, appear separately, thus forming gradually each volume. Up to date the first and the tenth volumes have been entirely completed.

Vol. I (from 1959 to 1962) comprises the cryptogamic plants. Fascicles of the volume: (In Vol. I/A) J. HORVÁTH (1959): *Bevezetés az általános mikrobiológiába* (Introduction in general microbiology) I/1. p. 86. — J. HORVÁTH (1960): *A nitrogénkötő baktériumok* (Nitrogen fixing bacteria) I/2. p. 46, Fig. 1. — J. BÁNHEGYI (1960): *A tejsavbaktériumok, Lactobacteriaceae* (Lactid acid bacteria, *Lactobacteriaceae*) I/3. p. 67, Figs. 7. — †I. Soós (1960): *Az ecetbaktériumok, Acetobacter-fajok* (Acetobacteria, *Acetobacter* species) I/4. p. 40, Figs. 4. — GY. NAGY (1960): *A butilalkohol-baktériumok* (Butylalcohol bacteria) I/5. p. 40, Figs. 15. — J. HORVÁTH (1960): *Az antibiotikumtermelő sugárgombák* (Antibiotics producing ray fungi) I/6. p. 52, Figs. 5. — E. KOL—L. MACHAY (1961): *A termesztett algák* (Cultivated algae) I/7. p. 62, Figs. 27, Coloured Tables 2. — SZ. PRISZTER (1961): *Függelék* (Appendix). (Supplements and indices for fasc. 1—7.) I/F/1. p. 94. (In Vol. I/B) — J. VÖRÖS—G. UBRIZSY (1960): *A penészgombák, Mucorales, Hyphomycetes* (Mould fungi, *Mucorales, Hyphomycetes*) I/8. p. 124, Figs. 30. — J. ZSOLT—†B. PAZONYI—E. NOVÁK—A. PELC (1961): *Az élesztők* (Yeasts) I/9. p. 132, Figs. 25. — M. BÉKÉSY—A. GARAY (1960): *Az anyarozs, Claviceps purpurea* (Fr.) Tul. (Ergot, *Claviceps purpurea* (Fr.) Tul. (I)10. p. 88, Figs. 38. — G. BOHUS — I. KORONCZY — S. ÜZONYI (1961): *A termesztett csiperke, Psalliota bispora* (Lange) Treschow (Cultivated mushroom, *Psalliota bispora* (Lange) Treschow) I/11. p. 162, Figs. 39. — SZ. PRISZTER (1962): *Függelék* (Appendix). (Supplements and indices for fasc. 8—11) I(F)2. p. 42, Fig. 1.

The series of flowering plants is introduced by the publication of the "Coloured Atlas" to Cultivated Plants of Hungary (1961) in Vol. X. This volume contains the coloured repro-

ductions of the artistic water-colours painted by V. CSAPODY, of the plants to be discussed in Vols. I—IX. The quart-form (24 × 34 cm) coloured pages represent partly the picture of habit, partly that of certain characteristic parts of the plant (some of them enlarged). On the whole about 220 species, subspecies, sorts and 210 varieties are included altogether in about 1300 detail-drawings.

With the contribution of several authors, the fascicles on flowering plants are, in the sequence of publication, the following: GY. MÁNDY—I. BÓCSA (1962): *A kender, Cannabis sativa* L. (The Hemp, *Cannabis sativa* L.) VII/14. p. 114, Figs. 44. — SZ. PRISZTER (1962): *A kerti laboda, Atriplex hortensis* L. (Garden orach, *Atriplex hortensis* L.) VII/7. p. 56, Figs. 19. — Á. BOROS—A. JÁNOSSY (1962): *A vetési csibehur, Spergula arvensis* (Spurrey, *Spergula arvensis*) VII/3. p. 36, Figs. 8. — Á. JESZENSZKY—I. KÁRPÁTI (1963): *A füge, Ficus carica* L. (The Common fig, *Ficus carica* L.) VII/12. p. 76, Figs. 36. — J. LELLEY—GY. MÁNDY (1963): *A búza, Triticum aestivum* L. (The wheat, *Triticum aestivum* L.) VIII/13. p. 341, Figs. 111. — A. PÉNZES—J. SZÉKÁCS (1963): *A franciaperje, Arrhenatherum elatius* (L.) J. et C. Presl (The tall Oat-grass, *Arrhenatherum elatius* (L.) J. et C. Presl.) VIII/17. p. 50, Figs. 16. — GY. MÁNDY — †A. HORVÁTH (1964): *A répa, Beta vulgaris* L. sl. és rokonai (takarmány-, cukorrépa, cékla, mangold) (The Beet, *Beta vulgaris* L. sl. and related plants (turnip-, sugarbeet, beetroot, mangewurzel) VII/5. p. 272, Figs. 107. — Á. BOROS (1964): *A turbolya, Anthriscus cerefolium* (L.) Hoffm. (The chervil, *Anthriscus cerefolium* (L.) Hoffm.) IV/3. p. 40, Figs. 23. — GY. MÁNDY—Z. CSÁK (1964): *A burgonya, Solanum tuberosum* L. (The potato, *Solanum tuberosum* L.) *Solanum* L. V/15. p. 320, Figs. 147. — I. MÁTHÉ—D. FÖLDESI (1965): *Az orvosi csucsor, Solanum laciniatum*, Ait. (The medicinal nightshade, *Solanum laciniatum* Ait.) V/17. p. 80, Figs. 52. — Á. BOROS (1965): *A sáfrány, Crocus sativus*, L. (The saffron, *Crocus sativus*, L. VIII/3. p. 48, Figs. 13, Coloured table 1.

This work supplies a great want in this country, however, in spite of being written in Hungarian, it might claim attention internationally, too. The further material to be worked up gradually, will appear in the following volumes:

Vol. II.: *Rosaceae—Saxifragaceae*

Quince (*Cydonia oblonga*) — Pear (*Pyrus domestica*) — Apple (*Malus sylvestris* var. *domestica*) — Service tree (*Sorbus domestica*) — Medlar (*Mespilus germanica*) — Raspberry (*Rubus idaeus*) — Brambles, blackberries (*Rubus procerus*) — Strawberry (*Fragaria ananassa*) — Apricot (*Prunus armeniaca*) — Almond (*Prunus amygdalus*) — Peach (*Prunus persica*) — Plum; Reine Claude (*Prunus domestica*) — Cherry (*Prunus avium*) — Sour cherry (*Prunus cerasus*) — Gooseberry (*Ribes uvacrispa*) — Red currant (*Ribes* -species).

Vol. III.: *Papilionaceae*

Lupine (*Lupinus*-species) — Fenugreek (*Trigonella foenum-graecum*) — Alfalfa (*Medicago*-species) — Bokhara clover (*Melilotus*-species) — Red clover (*Trifolium*-species) — Kidney vetch (*Anthyllis vulneraria*) — Birds foot trefoil (*Lotus corniculatus*) — Liquorice (*Glycyrrhiza glabra*) — Serradella (*Ornithopus sativus*) — Sainfoin (*Onobrychis*-species) — Peanut, groundnut (*Arachis hypogaea*) — Chick pea (*Cicer arietinum*) — Broad bean (*Vicia faba*) — Vetch (*Vicia*-species) — Lentil (*Lens culinaris*) — Chickling vetch (*Lathyrus sativus*) — Pea (*Pisum sativum*) — Soybean (*Glycine soja*) — Cow pea (*Vigna sinensis*) — Beans (*Phaseolus*-species).

Vol. IV: *Vitaceae — Cornaceae — Umbelliferae — Malvaceae — Linaceae — Euphorbiaceae — Asclepidaceae — Hydrophyllaceae — Boraginaceae — Vine (Vitis vinifera) — Cornelian cherry (Cornus mas) — Coriander (Coriandrum sativum) — Celery (Apium graveolens) — Parsley (Petroselinum crispum) — Caraway (Carum carvi) — Aniseed (Pimpinella anisum) — Fennel (Foeniculum vulgare) — Dill (Anethum graveolens) — Lovage (Levisticum officinale) — Common parsnip (Pastinaca sativa) — Carrot (Daucus carota) — Valerian (Valeriana officinalis) — Marsh mallow (Althaea rosea var. nigra) — Kenaf (Hibiscus cannabinus) — Cottonj upland (Gossypium hirsutum) — Flax (Linum usitatissimum) — Castor bean (Ricinus commu-*

nis) — Common milkweed (*Asclepias syriaca*) — Fiddleneck (*Phacelia tanacetifolia*) — Comfrey (*Symphytum* × *uplandicum*).

Vol. V.: *Labiatae* — *Solanaceae* — *Scrophulariaceae* — *Papaveraceae* — Rosemary (*Rosmarinus officinalis*) — Lavender (*Levondula*-species) — Garden sage (*Salvia officinalis*) — Balm (*Melissa officinalis*) — Savory (*Satureja hortensis*) — Hyssop (*Hyssopus officinalis*) — Marjoram (*Majorana hortensis*) — Common thyme (*Thymus vulgaris*) — Mint, peppermint (*Mentha* species) — Basil (*Ocimum basilicum*) — Deadly nightshade (*Atropa bella-donna*) — Belenine (*Hyoscyamus niger*) — Red pepper (*Capsicum annuum*) — Tomato (*Lycopersicon esculentum*) — Eggplant (*Solanum melongena*) — Thornapple (*Datura*-species) — Tobacco (*Nicotiana* species) — Mullen (*Verbascum* species) — Foxglove (*Digitalis* species) — Poppy (*Papaver somniferum*).

Vol. VI.: *Cruciferae* — *Cucurbitaceae* — *Compositae*
Black mustard (*Brassica nigra*) — Turnip (*Brassica rapa*) — Cabbage (and its variety (*Brassica oleracea*) — Rape (*Brassica napus*) — White mustard (*Sinapsis alba*) — Radish (*Raphanus sativus*) — Horse radish (*Armoracia rusticana*) — Gold of pleasure (*Camelina sativa*) — Loofah (*Lagenaria siceraria*) — Gourd, Field pumpkin (*Cucurbita* species) — Watermelon (*Citrullus lanatus* var. *casser*) — Melon (*Cucumis melo*) — Cucumber (*Cucumis sativus*) — Sunflower (*Helianthus annuus*) — Jerusalem artichoke (*Helianthus tuberosus*) — Chamomile (*Matricaria chamomilla*) — Safflower (*Carthamus tinctorius*) — Blessed thistle (*Cnicus benedictus*) — Cichory (*Cichorium intybus*) — Endive (*Cichorium endivia*) — Spanish salsify (*Scorzonera hispanica*) — Lettuce (*Lactuca sativa*).

Vol. VII.: *Aizoaceae* — *Portulacaceae* — *Caryophyllaceae*, *Chenopodiaceae* — *Polygonaceae* — *Moraceae* — *Cannabaceae* — *Betulaceae* — *Fagaceae* — *Juglandaceae*
New Zealand spinach (*Tetragonia tetragonoides*) — Purslane (*Portulaca oleracea* var. *sativa*) — Spinach (*Spinacia oleracea*) — Garden sorrel (*Rumex* species) — Rhubarb (*Rheum rhabarbarum*) — Buckwheat (*Fagopyrum*-species) — Mulberry (*Morus* species) — Hop (*Humulus lupulus*) — Hazel (*Corylus* species) — Chestnut (*Castanea sativa*) — Walnut (*Juglans regia*).

Vol. VIII.: *Liliaceae* — *Iridaceae* — *Gramineae* I.
Onion (*Allium* species) — Garden asparagus (*Asparagus officinalis*) — Saffron (*Crocus sativus*) — Brome (*Bromus* species) — Fescue (*Festuca* species) — Sodic-grass (*Puccinellia distans*) — Blue grass (*Poa* species) — Orchard grass (*Dactylis* species) — Crested dog's tail (*Cynosurus cristatus*) — Rye-grass (*Lolium* species) — Crested wheat grass, Couch-quitch (*Agropyron* species) — Rye (*Secale cereale*) — Barley (*Hordeum* species) — Bermuda grass (*Cynodon dactylon*) — (*Beckmannia eruciformis*) — Yellow oat grass (*Trisetum flavescens*)

Vol. IX.: *Gramineae* II.
Oat (*Avena sativa*) — Colonial bent (*Agrostis alba*) — Timothy (*Phleum pratense*) — Meadow foxtail (*Alopecurus pratensis*) — Sweet vernal grass (*Anthoxanthum odoratum*) — True canary grass (*Phalaris canariensis*) — Rice (*Oryza sativa*) — True millet (*Panicum miliaceum*) — Foxtail millet (*Setaria italica*) — Sorghum (*Sorghum* species) — Sudangrass (*Sorghum sudanense*) — Maize (*Zea mays*).

The treatment of our cultivated plants within the frame as outlined above, renders the importance and usefulness of the work extensive. Researchers, teachers and all those working in any branch of agriculture either theoretically or practically, will obtain, in modern synthesis, a scientific synopsis of and also comprehensive literary references on the cultivated plants discussed.

The work is being printed in painstaking finish by the Publishing House of the Hungarian Academy of Sciences, in the Printing Office of the Academy.

I. MÁTHÉ

EFFECT OF CHEMICALS ON INCREASING THE RESISTANCE AND HINDERING THE FUNGI INFECTIONS OF BÁNKUT 1201 WINTER WHEAT AND ON THE FORMATION OF THE N AND P CONTENT OF MFB BARLEY

FÖLDESI et al. (1965) successfully employed various concentrations of aqueous solutions of chlorbenzyl-oxynium-chloride, tributylonoxynate and dibutylondioxynate as fungicides on *Aspergillus niger* Van Tieghem, *Aspergillus amstelodami* (Mangin) Thom et Church, *Cheatonium globosum* Van Tieghem, *Penicillium cyclopium* Westling, *Penicillium brevi compactum* Dierckx, *Paecilomyces varioti* Bainier, *Stachybotrys atra* Corda. Of the mentioned chemicals dibutylondioxynate showed only a very limited fungicidal affect, never the less we did examine the affect of all three chemicals on relatively highly organized plants. The test plants in the greenhouse were two-leaf barley and wheat seedlings grown in garden soil. It was supposed that these fungicides might be employed as a spray if they do not harm the host plant.

A 0.05% solution of chlorbenzyloxynium-chloride caused scorched spots and hindered plant growth two days after application. The effect changed if the concentration was reduced to 0.025%; the barley still showed slight signs of damage which were not visible on the wheat; in fact there was an increase in growth.

The 0.05% solution of tributylonoxynate and the 0.1% solution of dibutylondioxynate equally caused scorching on both plants. (The effect of the two chemicals in series of dilutions was not examined.)

The dry-matter content of the test plants did not reduce under the effect of the treatment. Thus it is evident that respiration did not greatly increase in those variants showing scorching and stunted growth. Whenever the treatment resulted in an increased growth, there was also an increase in drymatter content during the course of the experiment.

Spraying also caused changes in the internal content of the test plants. Under the effect of chlorbenzyl-oxynium-chloride the total percentage value of nitrogen reduced for barley, while it increased for wheat. Tributylonoxynate caused a reduction of nitrogen content in both plants. At the same time the total phosphorus concentration of wheat remained unchanged while that of barley increased. Dibutylondioxynate also caused internal changes, but our experiment cannot be the basis of a description of these changes. We can only state that the metabolism of the two types of test plants reacts to the described treatments in different ways.

*

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REFERENCE

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CHRONICA



KURT SEDLMAYR

1900—1965

About 35 years ago a new epoch began in the history of Hungarian beet breeding, though nothing else happened but a young, capable farm manager set out to conduct breeding of beet on modern foundations. At this date beet breeding had already a past of two scores of years in Hungary still the varieties produced up to then had not been competitive with the foreign varieties and thus could not procure the expected success to their producers. Even the celebrated breeder of the Bánkúti wheat varieties LÁSZLÓ BAROSS had tried, without success, to produce new beet varieties. The beet varieties produced by himself and by his fellow-breeders at the beginning of the century could not defeat the foreign varieties patronized by the sugar factories which actually surpassed the Hungarian bred beets in their performance. Many experts had lost their hope in successful breeding and after World War I they did not initiate new work. Discouragement was so profound that as Sedlmayr himself stated in 1947 "in the years after the war more and more the opinion gained ground that the foreign sugarbeet varieties under Hungarian conditions were well suited and that chance had already been missed to stand up to the competition with the plant breeding establishments started hundred years ago."

Under such conditions Kurt Sedlmayr, the young farm manager and the founder and successful promoter of Hungarian beet breeding needed no little moral strength and self-confidence for the proposed work. Economic conditions were not favourable either. When he started his work and founded his establishment, the world still stood under the influence of the economic crisis of 1929. The crisis prompted him to leave the "sphere of interest" of the sugar factories and to make himself independent, since the sugar factory of Bük gave him notice in order to alleviate its burdens. So it almost involuntarily led the

young "practical economic engineer" on his way towards beet breeding, where so much success crowned his efforts.

It was due, first of all, to his outstanding capacities that he embraced the career of a successful breeder but his well known modesty prompted him to let others participate in his merits. In connection with his choice of profession he stated that "starting sugar beet breeding encountered great difficulties; but fortunately in this field a competent authority, the *Hungarian Institute of Plant Breeding* and its director ÖDÖN VILLAX took a stand for the Hungarian sugar beet breeders." Naturally, by "Hungarian sugar beet breeders" Kurt Sedlmayr himself must be meant since it was his successful work that encouraged others to deal again with sugarbeet. The "competent authority" may have paved the way with its stimulation for the future of sugarbeet growing but the realization, the expert and successful work required such personality as Kurt Sedlmayr who undertook the task and demonstrated that with adequate conceptions and persistence even the most difficult tasks could be solved.

The question arises, however, what was the concept that inspired him with hope? Sedlmayr himself gave the answer almost categorically: "to-day there can be no more doubt that for *Hungary* sugarbeet can be successfully bred only on the soil of the country. In the foreign arid countries i.e. in the eastern provinces of *Austria, in Slovakia, Roumania, Yugoslavia, Ukraine, on the Balkans, in Turkey* and in the dry regions of beet production the sugarbeet varieties bred here will be better, more resistant and of higher vitality than the western humid varieties". He proved his thesis with his successful varieties. He really succeeded in breeding new beet varieties that surpassed the best foreign ones and so he dispersed the false opinion according to which the Hungarian beet production had to content itself with foreign varieties.

There is no doubt that the year 1930 brought a significant turn in the history of Hungarian sugar beet breeding. In 1936 the National Institute of Plant Breeding certified two varieties of the hitherto unknown new breeder: the sugarbeets BETA C-242 and BETA Y-19. The new varieties not only stood the test against the foreign ones, but the variety BETA Y-19 distinguished itself also by resistance to *Cercospora* which property no other sugarbeet could claim at that time. Kurt Sedlmayr was the first to attain an outstanding success with this result.

The successful breeding work made sensation all over the country and soon attracted followers. At various places of the country (Ács, Röjtökmuzsaj, etc.) beet breeding was undertaken anew, which was to be attributed to the exemplary initiative of Sedlmayr giving a new start in the country beet breeding which, after World War I, could be considered as completely extinct. It was not up to the followers that they could in no way attain such results as Sedlmayr, as they lacked the rare capability of breeder that was so exceptionally present in Kurt Sedlmayr.

So started his career the eminent plant breeder in Sopronhorpács, Hungary, whose so untimely death has become known recently. This supplied the sad occasion to revive his life and activity.

Th. Kurt Sedlmayr was born on 31 August 1900 in Szarvaskő, then Sopron country (now Hornstein in Burgenland, Austria). His father, Ernst Kurt Sedlmayr was, at that time, chief manager on the farms of the Esterházy estate-tail in that village. His mother was Josephine Negro. He absolved his secondary school studies in the Döblinger Gymnasium Vienna subsequently to his

father's appointment as professor in the Hochschule für Bodenkultur on the chair of Farm Administration. He was also rector of the College more than once and rewarded with the title of doctor honoris causa and aulic councillor (Hofrat). After graduating from secondary school Kurt Sedlmayr, following family traditions, immatriculated at the Hochschule für Bodenkultur and gained the academic degree of farm engineer. In 1923 his doctor's dissertation entitled "Elemente einer exakten Sortenkunde bei Weizen" was the first to demonstrate that stand density is an important varietal feature in wheat. After having graduated from the College and obtained the degree of a doctor of agriculture he was sent to a study tour and spent a long time on the study of agriculture in the USA, Denmark, Holland, Germany and Yugoslavia where he gained rich experience.

On his return he came to the sugar factory Bük belonging to the Patzenhofer Sugar Factories Ltd., and as a farm engineer he worked here for several years and became acquainted with many problems of sugarbeet growing and sugar manufacturing. He married in 1928 and lived a happy life for 37 years, together with his wife, two sons and two daughters.

In 1929 under the pressure of the economic world crisis the Patzenhofer Sugar Factories Ltd. liquidated their leased farms, among others the farms in Bük and Lédec (Sopronhorpács) and Sedlmayr lost also his job. He rented the Lédec estate from its proprietor the Premonstratensian Order of Csorna and besides farming began his activities in plant breeding. His attention was directed to sugarbeet but he also soon became engaged in the breeding of winter barley. His new sugarbeet varieties BETA C—242 and BETA Y—19 obtained state certification in 1936 and at the end of the thirties were released for trade together with BETA rosa, a new fodderbeet variety bred by individual selection from a local variety of the Sopron county. At the same time he successfully worked on his new winter barley BETA 40 (Lédec BETA). And on issuing these varieties he established the BETA plant breeding farm, the unique objective of which was plant breeding, propagation of the improved strains and sale of the seeds of the new varieties. This farm worked independently until 1950 when it was nationalized and by government regulation transformed into the Sopronhorpács Experimental Farm to perform the same tasks. Kurt Sedlmayr became director of the new experimental farm.

In the forties his newly varieties obtained repeatedly state certification (Table 1.) and after the beet and winter barley the breeding of line also began and obtained state certification. The farm also extended its activities to the breeding of legumes.

Kurt Sedlmayr utilized for his successful breeding work not only his knowledge and rich experience but was also fortunate in choosing proper co-workers as ANTAL CSITKOVICS, ANDRÁS VARGA, KÁROLY WEIN and IMRE HOLLY. When organizing his increasingly modern breeding work he also readily turned for help to acknowledged specialists. Thus at breeding his polyploid varieties he established close contact with Prof. BARNA GYÖRFFY the geneticist and for the solution of issues in physiology and farmtechnology with the late Academicians Prof. DÁNIEL FEHÉR and LAJOS KREYBIG.

The Experimental Farm was transformed in 1951 into a Research Institute for Plant Breeding and Plant Production and Kurt Sedlmayr was appointed as Director of the new institute. Here an extensive breeding and research work was conducted with modern equipment and exemplary results. In acknowledg-

Table 1
New plant varieties bred by Kurt Sedlmayr

Plant species and name of the variety	Co-worker	Mode of state certification and year
<i>Sugarbeet</i>		
BETA C-242	—	C* 1936, 1940; R* 1942, 1948
BETA Y-19	—	C 1936, 1940, 1943, 1947, 1952
BETA 242/D	A. CSITKOVICS	C 1952
BETA 242—53	A. CSITKOVICS	C 1952
BETA K-91	A. CSITKOVICS	C 1952; R 1954
BETA poli 1	A. VARGA	PC* 1957
BETA poli 3	A. VARGA	PC 1957
<i>Fodderbeet</i>		
BETA rosa	A. VARGA	C 1944, 1947; R 1952
<i>Winter Barley</i>		
BETA 40 (Lédeczi BETA)	A. CSITKOVICS	PC 1943; C 1944, 1947; R 1947, 1952
<i>Winter Wheat</i>		
BETA-Bánkuti	—	C 1952
<i>Line</i>		
BETA 88 two way use	A. CSITKOVICS	PC 1945, 1947; C 1952
BETA 91 two way use	A. CSITKOVICS	PC 1947; C 1952
BETA 201 oil line	A. CSITKOVICS	PC 1955
<i>Hungarian Vetch</i>		
BETA Hungarian vetch	A. CSITKOVICS	C 1946, 1947; R 1954
<i>Chicory</i>		
Chicory Horpácsi	I. HOLLY	C 1962

*C= certified, PC = preliminarily certified, R = registered

ment of his valuable scientific activities Kurt Sedlmayr was in 1953 elected a member of the Hungarian Academy of Sciences and obtained the highest appreciation by the state when he was awarded the Kossuth prize on two occasions. He undertook a very active and successful work in the life of the Academy, mainly in the section of Agricultural Sciences. His scientific merits were acknowledged also abroad by being elected a consultative member of the German Agricultural Academy.

In the fifties he produced with his co-workers new wheat, line and chicory varieties which also obtained state-certification. These varieties stood

the test also in foreign trials and brought him much appreciation in many countries.

In 1956 he unexpectedly left the country for Austria and settled down in Vienna where in 1957 he organized the Austrian breeding institute of the AS De danske Sukker fabrikker in Essling, near Vienna. By the foundation, up to date development and successful work of the "Maribo" Plant Breeding Institute Kurt Sedlmayr organized the first sugarbeet breeding institution in Austria and with a relentless work conducted for eight years established the first Austrian sugar beet varieties. His death on 1 Mai 1965 was the pass of an excellent plant breeder of high capacities.

The life and activity of Kurt Sedlmayr was an example worthy to be followed for many young plant breeders in Hungary and abroad. During his breeding activities which extended to three and a half decades he created many valuable assets. This he could only achieve by considering his work as his vocation with his whole being penetrated by the great attachment to plant breeding on which he about twenty years ago stated: "plant breeding is neither a sheer sport nor in itself but a serious and responsible work for more and better production." In fact Kurt Sedlmayr did perform during his whole life a serious and responsible work and this was the secret of his success.

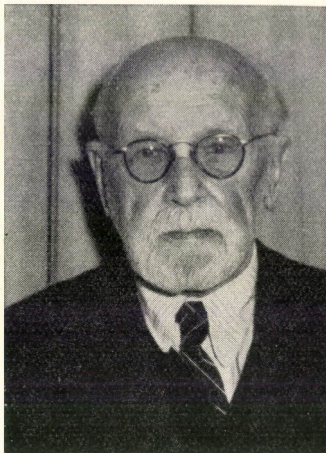
GY. MÁNDY

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JÓZSEF GYÁRFÁS

1875—1965

The death of JÓZSEF GYÁRFÁS, Kossuth-Prize holder, Director-General for Experimental Affairs, has been great loss for the Hungarian agricultural science. The life of the deceased was rich in results; his ideas survive and are leading not only for his contemporaries but also for the coming generation. The true value of great men, of great individuals is proved by their work being timeless and valid for the future.

He was born in Garany (County Zemplén) in 1875. After having finished his secondary school studies in Sopron, he became a student of the Magyaróvár Agricultural College. As early as the turn of the century that College was already famous all over Europe. Here the young student had the opportunity to acquire the theoretical and practical knowledge of farming from the most prominent Hungarian professors, like CSERHÁTI, KOSSUTANY, LINHART, ÚJHELYI etc. In the spirit of the diligent and talented scholar the lectures of these great professors made deep impressions, and he prepared conscientiously for his future career. In the year 1896 he finished his studies with distinction. In 1897 after one year of military service he returned to the Magyaróvár Agricultural College in the capacity of assistant professor, to work together with Prof. SÁNDOR CSERHÁTI. Two years later he was transferred to the Agricultural Experiment Station For Plant Industry — Magyaróvár the director of which was Prof. CSERHÁTI himself, where he had the opportunity of getting acquainted with CSERHÁTI's work closely, gaining practice in research work that, in those days, was being organized by the Station throughout the country. He took part in the collecting and evaluating of practical experiences to which activity importance had always been attached by his professor.

At the early age of 26 he was entrusted by CSERHÁTI with the management of the Branch of the Station at Arad which branch was directing research work in the Great Hungarian Plain. The task was difficult since he had to manage work, almost independently, in a region having the most unfavourable

climate. On the other hand, it was still a beautiful task because he had to follow yet untrodden paths and it was he who had to gain ground for intensive agriculture.

The years spent in the Great Plain were of decisive influence on his development as an expert. The independent sphere of activity rendered it possible to display his ability for original-initiative work and offered him the opportunity to get acquainted with the special soil- and climate conditions of the region, with the difficulties of farming.

Chance was also offered to study farming connected with irrigation the first initial steps of which were made during his stay in Arad. He took part in planning and realizing experiments with the aim of improving sodaic soils by way of irrigation. He had an important share in bringing about the Békéscsaba irrigated meadow still producing economic yields and was the first to carry out experiments on utilizing the city waste-water for irrigation purposes. His sphere of knowledge was greatly extended by his study tours made in Italy, France, Germany and Czechoslovakia. The treatise summarizing his studies and experiences concerning dry-and irrigation farming, won a competition in Germany.

After the sudden death of SÁNDOR CSERHÁTI, he was entrusted with the management of the Agricultural Experiment Station For Plant Industry — Magyaróvár. Walking in the footsteps of his great predecessor, he had been the leader of the Institute for 24 years. In the year 1917 he was appointed Director, — and in 1932 Director-General for Experimental Affairs.

Here he not only resumed the experimental work initiated by CSERHÁTI, but continued to develop it considerably. He made the results of research work acquainted generally in books and articles. Besides 19 original works, he wrote more than 600 special articles, and as the city-editor of "*Köztelek*", he directed a considerable field in the literature of plant growing.

After his retiring in 1941 he became, as recognition of his scientific work, honorary doctor of the Technical and Economic University, and in 1955 he was awarded the 2nd Grade of Kossuth-Prize "and as an acknowledgment of his excellent work done in the interest of developing agriculture", the Medal of Merits in Socialist Work. The Mosonmagyaróvár Agricultural College and High School, respectively, granted him "Golden" — and "Diamond" diplomas in 1958 and the "Iron" diploma in 1963.

The research work of József Gyárfás was of very wide scope. In those days when the foundation of agriculture had to be laid, this seemed to be a natural requirement. Agricultural production needed urgent replies to the problems raised; the leader of the state research center could not concentrate his attention to confined fields. The chief task of a research-worker was to choose from among the many problems to be solved, the most important and fundamental ones, doing his best to solve them. The explanation why Gyárfás could exert great influence on the development of agriculture, lies in the fact that his scientific education and wide-ranged practical knowledge rendered him capable always to focuss his attention on the most urgent problems. It was part of his method not to be satisfied with only the evaluation of the results of experiments; he was in close contact with the producing plants, collected and evaluated their experiences and observations and comparing these with the results of his own experiments, he elaborated the principles that could be introduced in practice.

The intensive developing of Hungarian agriculture has always been greatly hindered by drought devastating the crops from time to time. Therefore, the main efforts of Gyárfás were concentrated on efficient farming in our climate having a tendency to be dry, and on decreasing the damage caused by drought. In his most studied and appreciated work: "Hungarian Dry-farming — Efficient Farming in Drought", he writes the following: "I want to summarize all those experiences through which, according to present knowledge, the farmer might struggle against drought in the hope of real success". For the writing of this book, besides the scarce literature referring to the subject, he availed himself first of all of his experiences obtained and collected in the course of his activities exerted in the Great Hungarian Plain during the first dry-hot decade of the century. What he gave into the hands of farmers were not prescriptions but principles "...according to which they have to elaborate a dry-farming system most suitable under the given conditions". He discusses the soil cultivation of dry-farming, the drought-resistance of our field crops, the growing of fodder, rotations in dry-farming, fertilizing (manuring), the importance of good emergence and proper plant-care and the ways of directing them. He aimed at: "...comprising every detail of dry-farming in relation to plant-growing". The great success and the immeasurable effect of his book prove that his endeavours were really successful. He has submitted such a vast store of knowledge and experience from which one can derive today and will derive in future, too.

It was in those days the use of fertilizers began to become popular all over the world and in our country, too. Therefore Gyárfás — following the example of CSERHÁTI, — did his utmost to elaborate and propagate the right method of applying fertilizers. On the basis of experiences gained at the Russian plains being even dryer than ours, he started experiments concerning row-fertilizing, and after having obtained favourable results, he propagated this new method in Hungarian agriculture. Ever since, many an experiment and numerous experiences have proved the advantages and economical results of the method.

In our climate tending to be dry, the shortage of fodder is an ever-recurring problem. He therefore looked for plants and growing methods through which the supply in fodder crops could be covered even in droughty years. He was greatly concerned in alfalfa this being one of our most dry-resistant crop. He started to cultivate "Pannonia"-vetch which, on our better soils, gives higher and better yield than hairy vetch. On the chalky sand-soils of our dry regions he introduced the growing of white Bokhara clover.

His works written on the growing of oil-plants, on the use of fertilizers and of green manure, are very remarkable.

Most of his articles have appeared in the columns of the scientific review "Köztelek". In these he deals with almost every problem concerning plant-growing. He has written much on wheat growing, on maize, sugar- and fodder beet, alfalfa, on stable- and green manure and of course, on tilling, the use of fertilizers and the growing of fodder plants.

At an advanced age again he took pen in hand in the year 1956, in order to summarize his experiences in tilling problems that had aroused hot debates. He writes a book with the title: "Summer and early-autumn tilling for autumn crops with or without ploughing". In this work of about 80 pages, he shows the right trend to be followed. In the introduction he establishes his standpoint: "Reasonable soil cultivation mustn't be stiff; it has to be adapted to changing

circumstances. I have always proclaimed the importance of adaptive soil cultivation".

All his writing are characterized by a significant deepness they are meant for practical farming and are serving the development of agriculture. His writings are built up with logic, being worded in an exact and obvious manner. Each of his sentences is chiselled, distinct, unambiguous. He wrote even the simplest article with the control and self-criticism of the scientist. All these qualities have greatly contributed to his books and articles still being lasting; they are still the values of the special literature written on Hungarian agriculture.

He has imparted his vast knowledge and experience not only to the co-workers of the institute being directed by him; even after his retirement he continued to assist the young researchers. These latter follow the track that had been set by the life work of J. Gyárfás in the research fields of Hungarian plant growing.

G. LÁNG



EMIL GRÁBNER

1878—1955

On the 10th anniversary of the decease of Emil Grábner we commemorate one of the most popular, most widely known figures among those created modern Hungarian agrarian culture. In the given framework it were difficult to determine and delimit the activity and significance of the numerically not large but the more eminent set of specialists — with Emil Grábner among them — who after the turn of the century lifted Hungarian agriculture from the so to say centuries old stagnation and backwardness, creating almost from one day to the other the foundations of agriculture up-to-date in all respects and standing on European level. Providence almost lavishly produced men, one more talented and gifted than the other, for this immense work, as if anticipating that history would not leave much time to our people for undisturbed development of modern agriculture constituting and ensuring its reason of existence. In this work of vast dimensions and of rapid rhythm around the turn of the the century which has not sufficiently been assessed yet up to now, Emil Grábner is found among the leading personalities. The great creating and organizing genius of the epoch, professor CSERHÁTI soon recognized in the young man of extraordinary application and working ability, possessing a wide sphere of interest and unusual expertness in special knowledge, the co-worker that was up to the requirements of the epoch and to the tasks to be solved in every respect: in 1899 he chooses Grábner as his assistant for the chair of Plant Production of the Agricultural College of Magyaróvár. The young assistant aged hardly 21 had already disposed at that time of a wide practical experience because partly before his academic studies and partly subsequently he collected his knowledge with great diligence in farms of various regions of the country. In his first works he attracted the attention of farmers to the importance and methods of field production of vegetable crops.

However, CSERHÁTI, who had soon recognized the importance of plant breeding work developing in Western Europe, directed his attention towards the breeding of field crops and by placing the organizational work in Hungary

into the best hands, entrusted with this work his young but zealous and most accurately working assistant, Emil Grábner.

Grábner, surveying and assessing within a short time the given conditions and possibilities in this country, and in order to solve the tasks awaiting him as perfectly as possible he set out for a study tour abroad in 1906. Having visited nearly all plant breeding farms in Europe he in the Hungarian papers discussed his experience with an eager rapidity, disseminating the knowledge of the almost unknown discipline, plant breeding. He paid a special attention to the plant breeding institute of Svalöf, Sweden, which at that time was already among the first in the world. Being well aware of the magnitude of the task he knew no rest. Beside the legion of special papers and articles he called the attention of the official quarters in a great number of lectures and memoranda to the new science. And in the mean time he was untiringly going on with learning. In 1908 he wrote a manual summing up his studies under the title „Breeding of agricultural crops” (*A gazdasági növények nemesítése*) which, as the unique book of reference in Hungarian special literature for several decades helped and promoted the development of plant breeding in Hungary. The arduous and impassioned work was not in vain; in 1909, at the age of 31 he was entrusted to organizing the National Institute of Plant Breeding, the direction of which had been left to him until his retirement (during 28 years). So in Hungary, preceding the adjacent countries commenced in 1909 the systematic and well organized breeding work with the purpose and destination „of breeding crop varieties suited to Hungarian conditions, productive and at the same time of excellent quality and of introducing these into general cultivation to promote the increase of yields.” Nothing characterizes better the success of his zealous work — beyond his exceedingly rich literary production — than the fact that as soon as 1920 thirty Hungarian plant breeding farms were working under his guidance and supervision and Hungarian plant breeding, in advance of the neighbouring countries, stood on a leading place.

Emil Grábner beside the organizatory work at home did not neglect foreign relationships either. How his activity and wide special knowledge was appreciated also in foreign countries is evidenced by the fact that for a long period he was an active member of the German and Austrian plant breeders, associations as well as that of the International Association. Foreign special journals were always ready to publish his papers and he enhanced his reputation also abroad with a great number of lectures.

It is difficult to judge whether it was the irony of fate or a realistic approach of the facts that the wide strata of Hungarian specialists honoured in Emil Grábner not the plant breeder in the first place but the plant grower. Or is it a recompense for the strange, historical fact that his contemporary, the creator of the *Bánkuti* maize and world famous *Bánkuti* wheat varieties, one of our greatest and most modern plant growers, is first of all recorded in professional circles as a plant breeder? In my opinion the real historical assessment of both laborious lives still remains to be accomplished. No doubt it were difficult to measure the life activity of Emil Grábner by establishing the alternative wheather he did more for the development of agriculture in the field of plant breeding or crop production. Immediately before his retirement, in 1935 he published the great work of his life “Field crop production” (*Szántóföldi növénytermesztés*). In this vast work of more than 800 pages the real self,

the real creative individuality of Emil Grábner unfolds itself. This work also clearly points out how he could be such a zealous propagator of plant breeding; because he was, by intuition, an excellent plant grower. In his important work he handed over the rich experience and exceedingly extensive knowledge of a laborious life to his fellow farmers. This work unusual also in its dimensions in Hungarian special literature, was received by the specialists of crop production with enthusiasm evidenced by the fact in comparatively short time it appeared in four editions. In what his outstanding intellectual powers were also proved was that in spite of his advanced age and impaired state of health and in his solitude at *Magyaróvár*, he steadily followed with attention both the new results of scientific research and the requirements and developments of practical farming so that he could enrich his book with ever new data in every edition. He had just finished preparing for the press the 4th edition of his book when death summoned him off from among us.

His laborious life should be an example for generations to come in order to be worthy of him in developing and building further the work the foundation of which had been laid down by him.

J. BAJAI

RECENSIONES

J. HALMAI, I. NOVÁK: *Farmakognozia*, (Pharmacognosia), Medicina Könyvkiadó ("Medicina" Publishing House) Budapest 1963. With 350 Figures + 80 Pages of Supplement.

The new results obtained in the field of the cognition of drug plants, their continuously rising industrial utilization and the increase in the rate of their being grown have necessitated the writing and publishing of a new, long-needed technical book comprising the detailed and modern scope of drug plants and their parts (the drugs) to be employed in medical science. That necessity has been complied with, to the highest degree, by the leaders of the Institutes for Drug Plants and Knowledge of Drugs (Budapest Medical Univ., and Szeged Medical Univ., respectively, Prof. JÁNOS HALMAI and Prof. ISTVÁN NOVÁK, when publishing their work entitled Pharmacognosia. The value of the text-book is considerably enhanced through the competent and artful morphological, cytologic-histological drawings executed by VERA CSAPODI and ELISABETH HALMAI-SCHNELL, as well as the pains-taking finish of the Publishing House "Medicina".

The volume of the text-part illustrated with Figures, is 670 pages, the index a further 8-page and the register of subjects and names 32 pages. The manual is also supplemented by 36 coloured and 41 black-and-white Tables showing morphological paintings and drawings of plants. Concerning its arrangement, a brief *preface* is followed by the introduction in which the authors outline the connection

of drug plants, drugs and pharmacognosia along with enumerating the most prominent reference books, they also analyse the continuously increasing importance of drug plants and drugs, respectively. Otherwise, the book is divided into two main chapters: *general* part (50 pages) and the *detailed* part (600 pages).

The prominent material of the general part is the summarizing of history pharmacognosia showing the development and some important stages of this field of science from ancient times up to our days, laying emphasis on the Hungarian aspects supported with authentic data and illustrations. The part dealing with the history of development in the teaching of pharmacognosia in this country, and introducing the institutions engaged with drug plants as well as the scientific and commercial organs, might also claim to general attention — thus giving a picture of the volumen and the present situation of the drug plant problem in Hungary. The general part comprises also a survey of the occurrence of drug plants and of the utilization of drugs in ethnographic application and as stimulants. Finally, the authors discuss the gathering, processing and the trade of drugs, and submit brief outlines on drug plant growing. At the end of the general part the international terminology and the description of valid instructions referring to the nomenclature of drugs are added.

The second main chapter, the so-called detailed part, contains the scope of drug-knowledge; drugs' grouping was performed

according to the chemical composition of the active agent. On the basis of the above-said, the descriptions of 239 drugs, some antibiotics, enzymes and hormones are grouped as follows:

- I. Drugs containing carbonhydrated
- II. Drugs containing acids, acid anhydrides, acid amides
- III. Drugs containing floroglucine derivatives
- IV. Drugs containing alkaloids
- V. Drugs containing glycosides
- VI. Drugs containing bitter substances
- VII. Drugs containing tanning materials
- VIII. Drugs containing volatile oils
- IX. Drugs containing balms (balsams)
- X. Resins and resin-containing drugs
- XI. Milky juices (latex)
- XII. Fats and fat-containing drugs
- XIII. Drugs containing vitamins
- XIV. Antibiotics
- XV. Drugs of animal origin
- XVI. Tars
- XVII. Miscellaneous drugs, not belonging to the above chapters.

At the beginning of the chapters the modern biological, plantchemical or biochemical description of the compound-group in question can be found; here it is also that we get acquainted with the critically evaluated material of methods suitable for their detection and determination, respectively. Hereafter the description of drugs follows in alphabetic sequence. In the course of description the authors also touch upon the drug parent-plant and the drug itself, upon their microscopic examination and content materials, and the detection and determination of the latter. At the end of the paragraphs we find pharmacological data, historical references of drugs and their parent-plant.

Here it is to be mentioned that the authors, when compiling the detailed part, have taken into consideration the official drugs of the now valid Vth Hungarian Pharmacopoeia, the constituents of the tea-blends in *Formulae Normales* (Collection of prescriptions, ed. IV.) as well as the current drugs of foreign provenance and some other,

domestic, drugs being mainly employed in popular therapy. Furthermore, they discuss in full the drug plants and drugs discovered and utilized recently in pharmaceutical industry. (*Rauwolfiae rad.*, *Vincæ minoris herba*) as well as drug plants being the subject of investigations in our days.

In the course of arranging the subsequent chapters, the authors bore in mind the fact that in pharmacognosical literature one often might come across classifications different from the above; thus, in the following three chapters (XVIII—XX) they submit arrangements according to occurrence, morphology and effect, respectively.

Chapter XXI. gives detailed directive, enumerated by organs, on the pharmacobotanical testing methods of drugs. The meaning of the more frequently used foreign words is attached dictionary-like. — The *Appendix* (4 pages) following the detailed part contains a brief description of some less frequently used, mostly domestic, drugs (40 kinds). Here we find some vegetable raw materials waiting to be further detected, which might be taken into consideration by the official medical science.

On the basis of the above we can establish that the work: *Pharmacognosia* by J. HALMAI—I. NOVÁK, is, beyond the requirements of a text-book, a valuable, new and long-needed manual in this field of science which will serve as excellent book of reference for chemists, physicians, biologists as well as for plant growers and —breeders.

B. DÁNOS

A parasztság Magyarországon a kapitalizmus korában 1848—1914. (The Peasantry in Hungary in the Age of Capitalism, 1848—1914) Tanulmányok 1—2. köt. (Essays, Vol. 1—2.) Editor and foreword István Szabó Budapest, 1965. Akadémiai Kiadó (Publishing House of the Hungarian Acad. Sci.) 480, 758.

There have never been such favourable conditions for Hungarian historical science and agrarian histography, neither have existed such suitable circumstances for

monographic general work and archival researches than in these last ten years.

The dispute on the different trends of Hungarian historians: between the followers of liberal positivism, those of the history of conservative ideas and historical materialism has lasted for long centuries. The positive co-operation of historical schools and trends, the really comprehensive results of the workshops of historiography could not be brought about until these theoretical and methodological differences together with the great problems of Hungarian history and among them the agrarian problem, have been settled by the forces of world history in 1945 and later on, following 1956.

The dissolving of the different scientific groups and the proper valuation of the history of feudalism and capitalism in Hungary could ensue only after World War II, and as a consequence of social changes that have taken place since then. Nowadays, when systematical management can prevail in research work, too, the disciples of positivists and the previous followers of the history of ideas are to be found in a common camp of historians together with Marxists and with members of research-generations grown up in the teaching of historical materialism. To investigate the causes of social backwardness as a consequence of the unaccomplished 1848 revolution meant for the agrarian historiographers such requirements that could not have been solved, in these few years, by way of the old research methods and because the private scientists had to meet with individual difficulties. Such comprehensive result could be obtained only through the co-operation of the staffs of archives, of institutes for historical science and of experts with different learnedness, of technology-historians, of economy-historians and of ethnography-researches. The two-volume report published now by the co-operative of Hungarian historiographers, in which they have elaborated the history of peasantry in Hungarian capitalism, — is the result of such collaboration of researchers.

Comprehensive conception and uniform editorial principle hold together the various

parts because the leadership of the collective has been accepted by Prof. dr. István SZABÓ, professor of the Kossuth Lajos University Debrecen, who has been dealing intensively with the history of the Hungarian peasantry since the thirties. Among others, he had published a good summary on the subject (1940), produced two larger volumes of essays (1948, 1960), and issued several excellent treatises of his own results in different periodical reviews, proceedings (1952, 1958, 1961, 1963) on the problem of serfdom on the system of detached farms examining always in the domain of Hungarian economy and the history of settlement, the problems of the peasantry in the age of capitalism.

The members of the collective being writers of the essays of the two vast volumes have come first of all, from among the students of Prof. István SZABÓ, from the circles of Marxist economy-historians and ethnography researchers.

The full extent of the work is more than 108 printed sheet (40 000 n each). Structurally it consists of 6 independent parts containing altogether 18 reports of 15 authors. At the beginning of the first volume we find the high level prefatory treatise of the editor summarizing the outlines of the publication and the method of different chapters being partly of analysing, partly of systematizing character: thus giving a complex way of historical description which displays the maximal co-ordination of agrarian sciences as well as of historical and ethnographical ones. Fundamentally, the writers of the whole work try to find answer to the question under what conditions the capitalist transformation of the Hungarian feudal system occurred after 1848. Though as a result of the March bourgeois revolution, formal liberation of the villeins did happen, however, the total liquidation of the various survivals of the feudal villein-system, the situation between shires and peasants regarding the previous allodial properties and the statute labour, was not executed. All three treatises of the first part demonstrate the survival of serfdom after the Habsburg restauration.

One of the authors, Lajos FÜR analyses the discrimination of proprietary rights between the feudal lands in villein tenure and the peasant estate, the abuses of absolutism, the manoeuvring of the aristocracy in Parliament. He deals with the problem of farmstead cottars, with the dividing of the remaining and cut-over areas, with the forced separation of meadows and the depriving of licence for using forests. Another author, Sándor GYIMESI shows the types and origin of the settlement (contract) villages in the light of colonizing efforts of Hungarian feudalism. The treatise of the third co-writer Emil SIMONFFY examines the forcing of the commassation and the different commassation lawsuits which resulted in the peasants lands to be cut up even into smaller strips.

The second part of the volume contains, in connection with the peasants' production, the most interesting studies. In his paper Gyula VARGA weighs the problem of the traditional implements getting obsolete, the spreading of agricultural machines, factors promoting and inhibiting mechanization, among them the lack of capital. His treatise displaying vast knowledge of the material, evaluates, concerning the change of implements, the spreading and the role of Western European and especially of English machine import to Hungary.

Of the three independent essays of István BALOGH being published in the two volumes, the first one compares the farming and producing techniques of the Hungarian peasants in the decades previous and following the liberation of serfdom and later through bourgeois development. The author writes in details about the division and valuation of different farming and agricultural systems and rotations.

Having finished his treatise concerning the transformation of the technique of production in the fields of soil cultivation and animal breeding, his second study deals with the forms of organizing the area: the system based on farming in large units of fields, on fallow-cultivation, the compulsion of rotation and the detached farm system as used in the Plains. The extent and types

of detached farming, the development of their technique in production are discussed in details; neither does the author ignore their social and cultural bearings, especially with reference to the conditions in the region east of the river Tisza.

In the second volume besides landed peasants, the authors write also about landless peasantry as well as on the history of the development of peasant culture, autonomy and cooperative movements in the times up till the outbreak of World War II.

István OROSZ examines the gradual differentiation of the peasant estates, Péter HÁRSFALVI scrutinizes the "land protecting" manoeuvring of the so-called agrarian conservative politicians, while György SZABÓ discusses the role of the agricultural credit situation becoming always more and more difficult in the drift of free competition and being at the mercy of bank-capital as well as of usurious capital; finally, István VARGA examines the direct taxation system opposed diametrically to the interest of peasantry.

In the fourth part the history of landless peasants was elaborated. Zoltán SÁRKÖZI writes about the agrarian migrating workers, the so-called "season"- or "contract" workers and about the spreading of this kind of labour conditions in Eastern Europe, as well as of the economical and social conditions of these season workers; Imre KATONA describes in details other forms of periodical wage labours like groups of shipping, — railway, — building- and brick factory-workers and finally, the living conditions of the migrating navvy toilers. In the third study of this part István RÁ CZ gives numerical, comparative data that have not been published so far, on the migrating of surplus agricultural manpower first to the suburbs, then to overseas countries and on their partial return as well.

The fifth part of the publication is least elaborated, the main cause of which lies in the fact that Hungarian historians, while fighting against the danger of dogmatism and revisionism, — they run either into the error of economization or overestimation of outstanding, great men. When examining the

cultural and ideological setting up of social structure, — as pointed out also in the prefatory study of the editor István SZABÓ, — they neglect to write about the inferences of the peasant class-struggle. The very same authors like Sándor GYIMESI and István BALOGH when investigating the bearings of the education, autonomy and cooperation of peasants in the age of capitalism, do not notice and do not make their readers see all those structural and political consequences that could be derived just from their results gained in economic history.

In spite of it, the work is of positive character, encouraging further investigations and anticipating those problems which might rise on the occasion of elaborating the history of peasantry during capitalism in Hungary. The last chapter of the work, that of Emil NIEDERHAUSER, gives a glimpse on European conditions making comparisons between the Western European Prussian, British and the Eastern European Russian and the Southern-European agrarian development. At the end of the book an abundant list of references and registers are added. All these volumes are proceedings of the Agrarian Historical Committee of the Hungarian Academy of Sciences with a well got-up book.

GY. SZAMOS

A. SOMOS: *Zöldségtermesztés 1—2*. (Growing of vegetables 1—2) Mezőgazdasági Kiadó (Publishing House of Agricultural Books) Budapest, 1961.

The second, revised edition of the work of A. SOMOS "*Zöldségtermesztés*" (Growing of vegetables) 1—2 was edited in 1961 by the Publishing House of Agricultural Books and Periodicals.

The book of two volumes has been licensed by the Minister of Agriculture as a textbook at the College of Horticulture and Viticulture in Budapest.

In the first volume the author deals, to an extent of 245 pages, with the general issues of vegetable growing while in the second volume

the detailed knowledge of the growing of vegetables is exposed on 377 pages.

After an introduction on the concept of vegetable growing, its importance viewing in national economy and the nutritional value of vegetables, the eight chapters of the *first volume* discuss, the following material:

1. The chapter on *History of vegetable growing in Hungary and its regions of production* deals, besides the soil, climatic and relief conditions of the regions with local traditions of cultivation, present cultivation methods and publishes the maps of the regional districts.

2. Under the title *The biological foundations of vegetable plants* their origin and development under the influence of the most important environmental conditions (heat, light, water, nutrients) are treated.

3. In the chapter *Principles of soil cultivation, fertilizer application and crop rotation in the growing of vegetables* the author is treating the soil cultivation and fertilization works of the growing of vegetables, anticipating a thorough knowledge of soil cultivation and fertilizer application. In the part on crop rotations, along with general knowledges special examples from Hungarian vegetable husbandry are given for the succession of crops both in field growing without and with irrigation and in the conditions of growing under glass frames.

4. The chapter on *Buildings and production equipments* discusses materials used for building purposes, the principles of the location of buildings, their groupment, methods used in Hungary for the preparation of hotbeds for the raising of seedlings, the equipment of localities covered by glass and destined for the cultivation of mushrooms as well as of the storage rooms for vegetable.

5. In the chapter on *Propagation* the most important standard properties of the seed, the standard table for seed testing and methods of pre-sowing seed treatments are dealt with. After having exposed the guiding principles for determining distance between drills and plants in rows on the strength of the author's own experiments there follow informations on field seeding, rais-

ing of young seedlings and planting out. This chapter is enriched by several Tables useful for practical cultivation.

6. Under *Care of Plants* the subchapter "How to supply lack of moisture" deserves special attention.

7. In the last two chapters the harvest of products, their preparation for transport and modalities of winter storage are reviewed.

In the *second volume* the cultivation of cabbages, root and bulb crops, potatoes, melons, legumes, onions, sweet corn, leaf vegetables, perennial vegetables and Champignon mushrooms is dealt with in regular succession.

In the course of discussion the history of the vegetable crops, their economic significance, botanical and biological characterization, the description of varieties grown in Hungary and as to field production the special soil preparation, fertilization, propagation works and care of plants are presented. In the following the knowledge on harvesting, manipulating, transportation and eventual storage of products and finally on growing under glass frames, seed growing, diseases and pests is imparted.

It is a merit of the book that its contents are made richer and more illustrative by benefiting from a great number of data of Hungarian and foreign research. Many chapters mark pointing forward the pathway of modern progress.

The references after the scopes of themes help those being more profoundly interested to widen their knowledge beyond the limits set by the book.

As a summary of this review it can be established that the book contains much useful knowledge not only for university students but also for specialists working in practice.

Gy. MÉSZÖLY

G. UBRIZSY: *Növénykórtan I., II.* (Phytopathology I., II.) Akadémiai Kiadó (Publishing House of the Hungarian Academy of Sciences,) Budapest 1965. Second, revised

edition. The size of Vol. I is 579 p. with 121 text illustrations. That of Vol. II. 942 p. with 291 text illustrations. Issued in 3000 copies. Price Ft 220.—

The first volume of the revised second edition of the manual writes about general plant pathology. It gives detailed description on the symptomology of infectious diseases of plants, discusses the identification of diseases, the physiology of infection processes, as well as the conditions of the development and collapse of epidemics. The pathogeny and virulence of pathogens are divergent among the biotypes, and have, at the same time, an important role in the development of epidemics. In the infectivity of the pathogen, host-selection and host-spectrum also have a prevailing role. The chapters dealing with pathophysiology summarize especially modern material of data, they contain, in the first place, the metabolism and the biochemical mechanism of the pathological resistance of common parasites. On the basis of recent experimental results, the variety or family specificity of the metabolic-biologic relation between host-plant and parasite can nowadays be brought in connection with the scope of the knowledge of molecular genetics. The expounding of infection processes physiologically and biochemically in the scope of molecular biology reveals a modern interpretation of the relationships between host-plant and parasite. The different pathogenic grades of susceptibility and resistance as well as the mechanisms of types of protecting reaction, submit very important data for up-to-date plant protection. The biochemical characterization of the mechanisms of overcoming against the penetration of the pathogen, is of special importance from theoretical standpoint. Thus, the normergic reactions, the hypersensitive overcoming reactions and the histogen demarcation types might be characterized by identical biochemical mechanism, since the pathogenic infection is immediately followed by phenol-accumulation and simultaneously, the activity of oxidative enzymes also increases. The interpretation of the metabolic-physiological relations in

resistance and hypersensitivity serve partly the improvement of resistance, partly it offers possibilities that can be utilized in practice for the quick widespreading of chemical plant protection. After the pathogen had settled, the physiological characterization of its spreading in the phloem transport is very important from the view-point of practical plant protection, first of all because of the course of the disease. The synthesis, the efficiency mechanism and pathophysiological importance of the well-known toxins of the pathogens (fusaric acid, lycomeramine, methionine-sulphoximine, etc.) are also discussed in details in this volume in the context of metabolic processes.

The biological and biochemical characterization of plant diseases in one of the most important and most modern chapter of the volume written on general pathology. The change in enzymatic decomposition of sugars, in the activity of glycolic acid oxidase and in the energy transport processes is a very typical phenomenon in pathophysiological processes. The intensity of the deamination mechanism of amino acids and the rate of ammonia accumulation are also typical features of metabolic physiology. The initial stage of infections is characterized by enhanced protein synthesis as well as by the electrophoretic change of certain protein fractions in the course of diseases. The decrease in the intensity of protein synthesis is preceded by the special lowering of nucleic acid level in the pathogenic processes.

At the beginning of the infection the photosynthesis and polyphenol oxidation also increase while in later stages they diminish. The intensity of cell respiration gets first enhanced due to which the quantity of the most important macroerg phosphate the adenosine phosphate, on the other hand, gets reduced. After the progress of infection, however, respiration decreases and, at the same time, the level of adenosine phosphate increases. A very important part of the chapter on pathophysiology discusses the types on induced pathological resistance that can be called forth by metabolites and antimetabolites.

The description of the physico-chemical, micromorphological properties of plant viruses and the expounding of the symptoms of the illness, provides feasibility — on the basis of detailed testing descriptions, — for the pathological identification of virus infections. The chapter submits an interpretation of the physiological and biochemical mechanisms of virus infections in the scope of the modern knowledge on molecular biology taking into consideration the possibilities of protection.

Through detailed discussions concerning the ways of biological protection, the experimental chemotherapeutic plant protection and the biochemical mechanism of virus increase, — that long-needed manual lends assistance both in the theoretical research work and in practical plant protection.

The second volume introduces the plant pathogenic fungi on the basis of the modified MARTIN system. Besides the morphological and ontogenic data of the pathogens discussed in systematic sequence, the manual always stresses their pathogenic and pathophysiological importance primarily from the point of view of protection. On the basis of relationships between infection symptoms, mycological characterizations and host plant, the pathogenic fungi can be identified without fail, though detailed information on taxonomic keys and descriptions of the species had to be shortened considerably as compared to the first edition. The second volume ends with the biological importance of the relationship between parasite plants (*Cuscuta*, *Orobancha*, etc.) and their host, as well as with the evaluation of protection against the damage caused.

At the end of the volumes the several thousand bibliographic references are contained in 70 pages comprising the modern scope of knowledge in far-reaching modern science up to recent times. The references submit especially detailed data on Hungarian phytopathology literature both in connection with the general chapters and in respect of pathogenic fungi to be found in Hungary. The manual is complemented with several

indexes which facilitate the finding of data in the vast volumes.

The chapters of the two collected volumes being written with great scientific care, are well-proportioned, this being the merit of the editor. The manual discussing in details

the problems of basic research works through first of all, work in the field of research, however, it also serves the tasks of extensive practical plant protection successfully, introducing also theoretical basic problems.

B. I. POZSÁR

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The Editorial Office has since been transferred to Oxford; and at the CAB Review Conference held in July, 1965, it was recommended that the Editorial Office should become a full Commonwealth Bureau not later than 1967. Continuity is thus assured. This Bureau will cover world literature on both economic and social aspects of agriculture, and WAERSA will continue to be the principal means of disseminating information in the form of classified abstracts and review articles. Full bibliographical data are provided, and all titles are quoted in the original languages with English translations where necessary. Abstracts are printed in English.

The opportunity has been taken to develop the classification of subject matter, which is now arranged under 10 main headings — Agricultural Policy; Agricultural Products: Supply, Demand and Prices; Marketing and Distribution; International Trade in Agricultural Products; Finance and Credit; Economics of Production; Co-operation; Education and Training; Rural Sociology; and Research Methods and Techniques relating to the preceding sections, together with a selection of reference material. Under each main heading the material is further sub-classified according to a simple decimal pattern which is being progressively developed. Annual and quarterly author indexes and annual subject indexes are at present provided. Beginning with Volume 8 (1966) it is hoped also to include quarterly subject and geographical indexes.

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РЕЗЮМЕ

СЕЗОННАЯ И ГОДИЧНАЯ ИЗМЕНЧИВОСТЬ ДЕЙСТВУЮЩЕГО ВЕЩЕСТВА ВИНКАМИНА В *VINCA MINOR* L.

И. МАТЭ, И. ПРЕЧЕНИ

Vinca minor L. (барвинок, см. рис. 1) стал важным и разыскиваемым лекарственным растением. Введение его в производство в Венгрии сделало необходимым изучение его распространения, в первую очередь, с точки зрения изучения действующего вещества винкамина. В этой работе оцениваются данные 212 образцов винкамина, происходящих из 150 мест произрастания, расположенных в различных частях страны. Установлено, что спонтанное или субспонтанное появление *Vinca minor* L. наблюдается чаще в западных районах страны (напр. Западные Задунайские р-ны и Малая низменность). В этих районах содержание действующего вещества выше, чем в восточных районах страны (напр. Затиссайские р-ны, Ниршер). На основании трехлетних данных видно, что количество действующего вещества довольно сильно варьирует и по годам.

ИЗМЕНЧИВОСТЬ КВАНТИТАТИВНЫХ ПРИЗНАКОВ КУКУРУЗЫ ПОД ВЛИЯНИЕМ ОБЛУЧЕНИЯ ГАММА-ЛУЧАМИ

А. БАЛИНТ, Й. ШУТКА

Воздушно-сухие семена инцухтированной линии С—5 были обработаны гамма-лучами при дозе 5000 и 15 000 R. В M_1 поколении наблюдались аномалии роста и развития, т. наз. «радиоморфозис». В поколении M_2 изменчивость количественных признаков увеличилась по сравнению с необлученной популяцией. Установлено, что 5000 R увеличивает частоту плюсовых вариантов в большей мере, чем 15 000 R. Широкая изменчивость проявилась и в поколении M_3 , в котором облучение и 15 000 R увеличило изменчивость некоторых признаков.

ВЛИЯНИЕ ОБЕСПЕЧЕННОСТИ БЕЛКОМ СОСУНКОВ НА РЕЗУЛЬТАТ ОТКОРМА И УБОЯ СВИНЬИ БЕЛОЙ ВЕНГЕРСКОЙ КРУПНОЙ ПОРОДЫ

Л. ЧИРЕ

Изучалось влияние переваримого белка, скормленного в различных количествах поросятам свиньи белой венгерской породы в возрасте от 30 дн. до 70—80 дней. Откорм проводился до достижения поросятами веса 110—120 кг. С точки зрения качества товарного мяса в обоих опытах наиболее благоприятным способом откорма был умеренный откорм до 70—80 дн. с последующим обильным обеспечением белком. Эти свиньи наряду с одинаковым использованием белка дали примерно на 6% больше мяса с костями.

ТРАНСПЛАНТАЦИЯ ЧАСТИ ПЛОДА У *SOLANUM MELONGENA* L.

Э. РАЙКИ, ДЬ. ПАЛ

Изучалась трансплантация части плода у многосемянных плодов на различных сортах баклажан *Solanum melongena* L. Установлено, что прививка части многосемянного плода удается успешно. Трансплантированные плоды приживаются, семена в них вызревают, а при посеве прорастают, и в зависимости от комбинации прививки изменяются по ряду свойств. Приживания не наблюдается при трансплантации более старых плодов и в случае, если срез проводился по длине плода или в верхней части, там, где расположены семена.

О ВЛИЯНИИ ПОЛИПЛОИДИИ НА ИЗМЕНЕНИЕ СОДЕРЖАНИЯ НЕКОТОРЫХ ХИМИЧЕСКИХ СОЕДИНЕНИЙ В ПЫЛЬЦЕ САХАРНОЙ СВЕКЛЫ

В. Е. БОРМОТОВ, И. В. МАТОШКО, В. К. СЕВЧЕНКО

В результате исследования установлено, что между диплоидами и тетраплоидами нет каких-либо определенных различий по количеству фосфорных и азотных соединений, содержащихся в единице веса их пыльцы. Однако, содержание названных соединений в функциональной единице — одном пыльцевом зерне — изменяется в связи с изменением степени пloidности вполне определенно. Удвоение набора хромосом прежде всего приводит к двукратному увеличению содержания ДНК. Прямая пропорциональная зависимость отмечается также для суммарной РНК, фосфопротеидов, липоидов, кислорастворимых фосфорных соединений, белков, а также небелковых азотистых соединений.

Удвоение ядерных элементов вызывает нарушение установившихся соотношений между ядром и цитоплазмой. В процессе дальнейшей жизнедеятельности ядро определяет изменение количественной стороны процессов метаболизма. Это приводит к увеличению размеров и веса клетки, а также увеличению числа некоторых клеточных структур (пластиды, мембраны, поры и др.). Таким образом полиплоидия путем изменения количественных соотношений в клетке важнейших химических соединений определяет изменение фенотипа растений и их физиологии.

ИЗУЧЕНИЕ ВЫДЕЛЕНИЯ ЭФИРНОГО МАСЛА С ПОМОЩЬЮ СВЕТОВОГО МИКРОСКОПА У *VALERIANA COLLINA* WALLR.

И. Наблюдения по выделению масляных тел и их морфологических особенностей.

Р. Г. СЕНТПЕТЕРИ, Ш. ШАРҚАНИ, Л. ФРИДВАЛЬСКИ, Л. НАДЬ

Изучено образование, аккумуляция и превращение эфирного масла в вегетативных органах, в первую очередь, в молодых и более старых корневых тканях *Valeriana collina* Wallr. Установлено, что в корне выделяются масляные тела трех видов. Из них «масляное тело калиптра» является продуктом диссимиляции в процессе деления меристематических клеток, которое отделяется от корня вместе с клетками калиптра, которые постепенно отмирают. Количество масляных тел, образовавшихся в коре и гиподермисе в зоне вытягивания или корневых волосков, изменяется в процессе вегетации. Следовательно, можно заключить, что они реактивируются.

ВЛИЯНИЕ СВЕТА НА КАТАЛАЗНУЮ АКТИВНОСТЬ ЛИСТЬЕВ

Й. П. МИХАЙФИ

На основании опыта определено, что активность каталазы сильно реагирует и на изменение активности света. Предполагается, что отношение активности каталазы, измененной на свету и в темноте в физиологически одинаковых листьях, может быть использовано как диагностический показатель.

ВЛИЯНИЕ СРОКА ПОСЕВА НА УРОЖАЙ КЕНАФА *HIBISCUS CANNABINUS* L

ФАРУҚ ЭЛЛ—ТОХАМИ ОРАБИ

Предшествующие эксперименты, проведенные с целью изучения агротехнических приемов на урожай кенафа подчеркивали значение посева на урожай и на количество волокна. Урожай зеленых стеблей, волокна и семян постепенно снижались при более поздних посевах.

ИДИОБЛАСТЫ И ИЗУЧЕНИЕ ИХ ЭКСКРЕТУМОВ В ПЛОДОВОЙ ОБОЛОЧКЕ КИЗИЛА *CORNUS MAS* L.

Г. ЮХАС, Б. ДАНОШ

В процессе гистогенетических исследований (Юхас, 1964), которые проводились в связи с развитием соцветия и цветка видов *Cornus mas* удалось показать наличие более или менее изодиаметрических идиобластов, создающихся лизигенным способом во внутренней одревесневшей стенке плода (в стенках плода плодолистикового происхождения). Ко времени созревания в них появляются желтые или оранжевые, иногда бордово-красные твердые и стекловидно-блестящие образования. По сравнению с настоящими янтарями они в воде и этаноле не растворяются. Из их растворов пока-что удалось идентифицировать свободные и находящиеся в эстеровых соединениях галлусовую и в следах дигаллусовую и хлорогенную кислоты.

ДАННЫЕ ПО ЗЕЛЕНОМУ УДОБРЕНИЮ РИСА

И. ШИМОН

В течение трех лет (1958—1960) на солончаке без извести было проведено зеленое удобрение разных сортов риса с помощью смесей ржи или ячменя с мохнатой викой.

В экспериментах зеленое удобрение дало повышение урожая на 16%. Но метод все-таки нельзя рекомендовать для общего внедрения, т. к. он не является экономичным. Зеленую массу выгоднее использовать на корм, т. к. пожнивные и корневые остатки сидерита также повышают урожай риса на 11%, и, вместе с этим, хозяйство получает ценный зеленый корм.

ГИСТОЛОГИЧЕСКОЕ ИССЛЕДОВАНИЕ КАЛЛЮСА У ЧЕРЕНКОВ МЯГКОСТЕБЕЛЬНЫХ И ДРЕВЕСНЫХ САДОВЫХ РАСТЕНИЙ

Л. ГЁРГЕНИ

Автор проводила гистологические исследования размноженных черенками мягкостебельных и древесных садовых растений, используемых в практике садоводства, с целью определить, должно-ли образование каллусной ткани, появляющейся на поверхности ранения, определить появление органа, а также ответить на вопрос, образуются-ли органы из этой ткани. Установлено, что образование органа может начаться независимо от появления каллуса. Это часто наблюдается у мягкостебельных растений, но встречается и у древесных растений. Образование органов или корней в каллусной ткани не обнаружено ни у мягкостебельных, ни у древесных растений.

ВОЗМОЖНОСТИ ЗАЩИТЫ ОТ КАРТОФЕЛЬНЫХ ВИРУСОВ

II. Опыты с использованием немецкого и улучшенного немецкого методов.

Й. ХОРВАТ

Изучалась пригодность немецкого и улучшенного немецкого методов для поддержания и улучшения состояния посевного материала картофеля. Установлено, что при выращивании семенного картофеля немецким и улучшенным немецким методами зараженность вирусами, как правило, снижалась в последующем поколении.

УЛУЧШЕНИЕ ПЕСЧАНЫХ ПОЧВ В ПРОВИНЦИИ ТАХРЕЕР С ПОМОЩЬЮ ГЛУБОКИХ ПОДСЛОЕВ

ФАТХИ МОГАМЕТ—АЛИ МАКЛЕД

39 лизиметровых делянок были набиты песчаной почвой из провинции Tahreer. Глубокие подслои (глина, навоз) были на глубине 50, 60, 70 см. и изолирующие материалы на глубине 60 см. В этих лизиметрах были посеяны ячмень и арахис. В опыте изучалось влияние вышеприведенного мероприятия на просачивание воды и на урожай. Полученные результаты ясно показали, что любой глубокий подслой оказался лучше, чем контроль или поверхностное внесение навоза. Даже вариант с изолирующей подслоем, следующий за глубоким внесением навоза, оказал лучшее влияние, чем вариант с подслоем в виде глины. Результаты этой работы соответствуют результатам подобных работ других авторов.

ИЗМЕНЕНИЕ СУТОЧНОГО РИТМА В СОДЕРЖАНИИ СОЛАСОДИНА В «ПРОМЫШЛЕННЫХ» ПОБЕГАХ *SOLANUM LACINIATUM* AIT.

Й. ВАРАДИ, Е. ЧАПО, Я. ХАЛМАИ

Изучалось суточное изменение содержания соласодина в «промышленных» побегах *Solanum laciniatum* Ait. Установлено, что концентрация соласодина в кончиках побегов днем сокращается, а ночью или рано утром увеличивается.

ВЛИЯНИЕ ПОСЕВА ЛУЩЕНЫХ И НЕЛУЩЕНЫХ СЕМЯН НА ПОЯВЛЕНИЕ ВСХОДОВ АРАХИСА *ARACHIS HYPOGAEA* L.

Е. А. К. САЕЕД

Опыт был заложен 23 авг. 1964 г. с целью изучения влияния посева лущеных и нелущеных семян на появление всходов у двух сортов (Ashford и Rubatab) арахиса (*Arachis hypogaea* L.). Результаты показали, что посев нелущеных семян задерживает появление всходов и уменьшает травостой. Далее, семена с нижней части обыкновенно прорастают позже, чем семена с верхней части из-за незавершенного периода покоя. Однако первые имеют более высокий процент масла, чем последние.

CHANGING OF VINCAMINE AGENT IN VINCA MINOR L. ACCORDING TO REGION AND THE YEAR OF GROWTH

By

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Since *Vinca minor* L. (small evergreen, Fig. 1) has become an important plant in pharmaceutical industry and has even been introduced in Hungary, it became necessary to study the places of its occurrence in this country first of all with regard to the vincamine agent. The present study evaluates the vincamine data of 212 samples gathered from about 150 places of occurrence considering the regions and the years of growing. It can be established that the spontaneous or subsontaneous *Vinca* populations occur the most frequently in the western regions of Hungary (e.g. the Western Transdanubian District, the Little Plain) containing, in their majority, more agent than those of the eastern regions of the country (e.g. the territory east of the river *Tisza*, the *Nyírség*). From the data of three years it can also be seen that there are considerable quantitative differences in the agent due to the year of growing.

Introduction

Since 1962 throughout three years regular investigations have been carried out in order to establish the vincamine content of the domestic *Vinca minor* L. furnishing a medicine that decreases blood pressure and is of sedative effect. On the pharmacological importance of vincamine and on the examinations made regarding the growing in this country, the following publications are available: SZÁSZ—SZPÖRNY et al. (1958), SZPÖRNY—SZÁSZ (1958), SZÁSZ—KOVÁTS et al. (1958), SÁRKÁNY, Mrs. (1962), MÁTHÉ (1965); of the publications on the changing of the agent and issued abroad, the following might be mentioned: HAJKOVÁ—HOMOLA—NAVRATIL (1959), HAJKOVÁ—SKÁCILIKOVÁ (1961), KOCZMAREK—LUTOMSKI (1962) etc.

In the course of our investigations with more than 200 samples from different regions of the country, laboratory examinations were performed. The observation data of the year 1962 have already appeared; see MÁTHÉ—SZABÓ, Mrs. (1963). The data of the years 1963 and 1964 submitted in this paper together with the data of 1962, might provide some information on the variance of the agent not only according to the region but also to the year of growing.



Fig. 1. *Vinca minor* L. Keszthely "Büdöskúti-völgy", in Quercu-Carpinetum (Photo: Kovács)

Materials and Method

Table 1 and Fig. 2 give detailed information on the test material concerning place, time of gathering and agent. (As to the enumeration of data on the samples of gathering, see MÁTHÉ—SZABÓ, 1963; on the sketch-map [Fig. 2], not only the districts of gathering in 1963 and 1964 but also those of 1962 are presented.)

Spots of sample-gathering, ecologic and coenologic circumstances are not dealt with in this paper (they will be written about later); here we only want to mention in general the following: The places of occurrence are mostly subspontaneous growing areas (abandoned

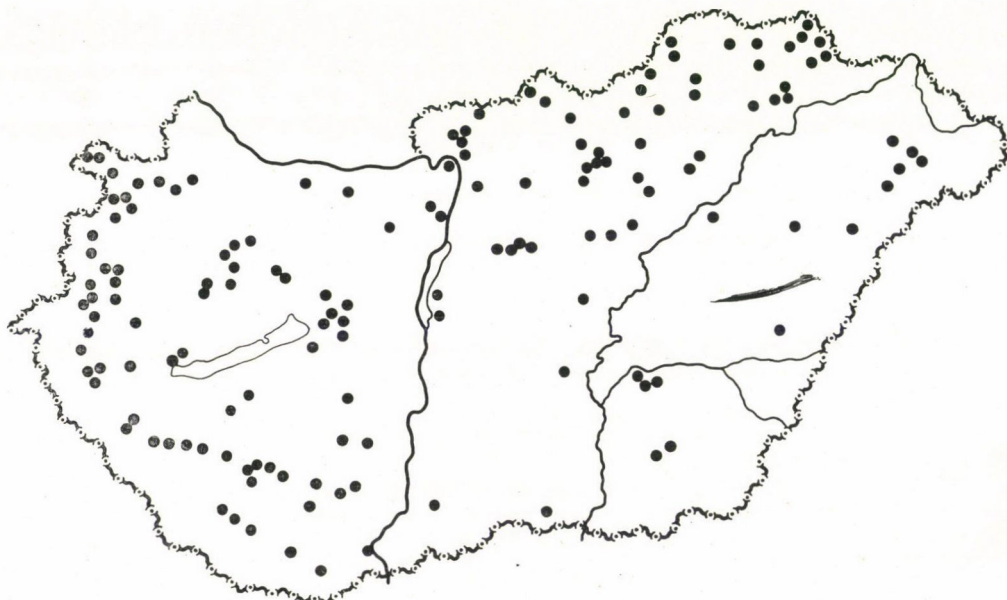


Fig. 2. Places of *Vinca minor* L. samples being gathered to examine their vincamine content, — 1962—1964

Table 1

Data on the Vinca minor L. samples gathered all over the country in 1963—1964

Places	Time	Vincamine %
<i>Nyugat-Dunántúl (West-Transdanubia)</i>		
Ágfalva	V, 14, 1963	0.29
	VI, 8, 1964	0.47
Sopron	V, 14, 1963	0.90
	VI, 8, 1964	0.89
Nagyecenk	V, 14, 1963	3.04
Vasvár	V, 15, 1963	2.51
	VI, 9, 1964	1.40
Táplánszentkereszt	VI, 9, 1964	1.40
Zalatárnok	VII, 18, 1963	0.73
Ujkér	V, 15, 1963	1.45
Bük	V, 15, 1963	2.22
Csempeszkopács	VII, 19, 1963	1.03
Tanakajd	VII, 19, 1963	1.72
Magyarszecsőd	VII, 19, 1963	1.96
Körmend	VI, 9, 1964	1.11
Egyházasrádóc	VI, 9, 1964	0.52
Lövő	VI, 9, 1964	0.42
Szombathely	VI, 9, 1964	1.05
Halastó	VI, 9, 1964	0.74
Budafa	VI, 9, 1964	0.63
Kálócfa	VI, 9, 1964	1.82
<i>Dél-Dunántúl (Southern Transdanubia)</i>		
Böhönye	V, 21, 1963	1.01
Lad	VII, 18, 1963	0.35
Botykapeterd	VII, 18, 1963	0.30
Nagybajom	V, 21, 1963	0.50
Korpavár	V, 21, 1963	0.46
Nagykanizsa	V, 21, 1963	0.62
	VII, 18, 1963	0.76
Kaposfő	V, 21, 1963	0.62
Vése	VII, 18, 1963	0.19
Somogyapáti	VII, 18, 1963	0.68
Mecseknádasd	VII, 17, 1963	0.76
Baranyajenő	IV, 15, 1964	1.05
Kistormás	IV, 15, 1964	2.11

Places	Time	Vincamine %
Bószénfa	IV, 16, 1964	1.05
Somogybabod	IV, 16, 1964	1.45
Hőgyész	V, 15, 1964	1.19
Mosdós	IV, 15, 1964	1.32
Sántos	IV, 15, 1964	1.11
Komló	IV, 15, 1964	1.32
<i>Dunántúli Középhegység (Transdanubian Middle Mountains)</i>		
Tapolcafü	V, 16, 1963	0.93
Bakonytamási	V, 16, 1963	0.76
Olaszfa-Eplény	V, 16, 1963	0.74
	VI, 10, 1964	0.68
Zirc	X, 24, 1963	0.79
Bicske	VI, 8, 1964	0.42
Bakonyjákó	V, 16, 1963	0.49
Csót	V, 16, 1963	0.47
Somlóvásárhely	V, 16, 1963	1.26
Somlójenő	V, 16, 1963	1.03
Büdöskút (Keszthely)	V, 22, 1963	1.36
<i>Kis-Alföld (Little Plain)</i>		
Kapuvár	V, 14, 1963	0.47
	VI, 8, 1964	1.21
Csorna	V, 14, 1963	0.79
	VII, 19, 1963	3.51
	VI, 8, 1964	1.61
Bábolna	V, 14, 1963	2.10
	VI, 8, 1964	0.68
Tata	V, 14, 1963	1.29
	V, 14, 1963	1.00
	VI, 8, 1964	1.13
Mihályi	VII, 19, 1963	0.40
<i>Dunavidék (Danube-District)</i>		
Lepsény	V, 22, 1963	0.49
Soponya	V, 20, 1963	1.45
Pincehely	V, 20, 1963	0.71
Kálóz	V, 20, 1963	2.24

Places	Time	Vincamine %
Szabadbattyán	V, 20, 1963	2.01
Balatonszabadi	V, 20, 1963	1.12
Polgárdi	IV, 16, 1964	1.11
Ósi	VII, 17, 1964	0.63
<i>Duna-Tisza köze (Territory between the Danube and the Tisza)</i>		
Mende	V, 8, 1963	0.74
	IV, 30, 1964	0.97
Tápiószecső	IV, 30, 1964	0.66
Maglód	IV, 30, 1964	0.84
<i>Tiszántúl (Territory east of the river Tisza)</i>		
Vatta	VI, 20, 1963	1.42
	VI, 30, 1964	0.66
Mezőnyárad	VI, 20, 1963	1.17
	VI, 30, 1964	0.74
Kerecsend	VI, 18, 1963	0.27
	VI, 29, 1964	0.79
Darvas	V, 10, 1963	0.87
	IV, 28, 1964	0.97
Öcsöd	V, 10, 1963	1.66
	V, 27, 1964	1.24
Szarvas	V, 10, 1963	0.47
	V, 27, 1964	0.95
Orosháza	V, 10, 1963	0.87
	V, 27, 1964	0.95
Jászfákóhalma	V, 8, 1963	0.66
Egyek	IV, 30, 1964	0.58
<i>Nyírség (Nyírség-District)</i>		
Baktalórántháza	V, 9, 1963	1.13
	V, 9, 1963	1.13
	IV, 29, 1964	0.79
Hajdúsámson	IV, 29, 1964	0.79
Ór	IV, 29, 1964	1.19
Nyírmeggyes	IV, 29, 1964	1.11
Nyírbogát	IV, 29, 1964	0.79

Places	Time	Vincamine %
<i>Északi Középhegység (Northern Middle Mountains)</i>		
Mátrafüred	IV, 19, 1963	0.07
Bánréve	VI, 29, 1964	1.61
Felnémet	VI, 18, 1963	1.50
Jósvafő	VI, 20, 1963	1.13
	VI, 29, 1964	0.55
Ragály	VI, 19, 1963	0.84
Rakaca	VI, 30, 1964	0.47
Sajószentpéter	VI, 20, 1963	1.79
Szemere	VI, 19, 1963	0.84
Telkibánya	VI, 30, 1964	0.60
Hollóháza	VI, 20, 1963	0.34
	VI, 30, 1964	1.00
Füzér	VI, 20, 1963	0.57
Erdőhorváti	VI, 20, 1963	1.63
Erdőbénye	VI, 20, 1963	0.49
Tálya	VI, 21, 1963	1.22
Rétság	VII, 28, 1963	0.87
Parád	IV, 18, 1963	0.18
	IX, 11, 1964	0.68
Parádóhuta	V, 8, 1963	2.51
Csevicekút	IV, 18, 1963	0.53
Edelény	VI, 19, 1963	0.62
Ipolyszög	IV, 29, 1964	0.68
Nógrádszakál	VII, 26, 1964	0.74
Borsodnádasd	VI, 29, 1964	2.30
Tolcsva	VI, 30, 1964	0.50
Novajidrány	VI, 30, 1964	0.47
Nagybozsza	VI, 30, 1964	0.74

cemeteries, parks, woods being under anthropogenic effect, etc.). In the case of seemingly spontaneous occurrence, e.g. hornbeam woods (*Carpinetum*), in hornbeam-oak forests (*Quercus-Carpinetum*) too, the influence of human life or at least some former traces show themselves or, in most cases, might be supposed. Furthermore, it is generally characteristic both of the *Vinca* stands being under greater or less cultural effect, that they first of all like shadow and spread at shady places; often it can be observed that as soon as the shading plants (trees, shrubs) are felled, from the area left open, it gradually dies out or draws back under the shadow.

We have examined the leaf-material dried at 60–70° C of the gathered samples being treated under the same conditions. The determination of total alkaloids was carried out according to the SZÁSZ–LŐRINCZ amphi-indicator method (SZÁSZ et al. 1959); while the vincamine determination was performed by way of the thin layer chromatography method elaborated in the Research Institute for Medicinal Plants (SZABÓ–PAPP 1962).

Results and Discussion

Summarising and ranging into vincamine-value categories the three years' data (Table 2), we can see that though the number of samples representing the region is rather unequal in such regional grouping, it becomes clear that in the western regions there are more samples with higher vincamine content than those in the eastern regions. It is also perceivable that regarding the year, 1963 was the most favourable for the vincamine yield; besides, it can also be seen that — depending on years, — there are considerable differences both in the low- and high vincamine value categories.

Our data were examined divided geographically into two groups: whether they came from regions being west or east of the Danube. As to vincamine content, we had three quantity-value categories (0—1% = poor, 1—2% medium, 2—3% good vincamine yield). According to the above mentioned classifying the frequency distribution of vincamine content in our gathered samples is shown in Table 3. As shown by the chi-square values, there can be established a connection between the two classifications. The frequency data of the vincamine % values of the three years being treated together, but divided into two geographic groups (west or east of the Danube), are shown in Table 4. In this case, too, a relationship could be experienced between the two classifications; the lower values show themselves in the eastern regions east of the Danube. When examining in the two geographical regions the distribution of the yearly vincamine %, we might see that west of the Danube the relationship between the two classifications is slighter than east of the Danube. From this it can be concluded that roughly speaking the frequency of samples with higher vincamine content, is better in the west than east of the Danube.

Conclusion

Concerning the agent, for the pharmaceutical industry more valuable *Vinca* plant material can be gathered from the western regions of the country. This investigation might serve as useful instruction as to the procuring of plant material for growing and propagating purposes; our investigation refers to the whole country submitting information not only on certain regions but also on the places of occurrence. It is also of importance that — depending on the year of growing, — we have to reckon with considerable quantitative difference in the agent and the fluctuation of same.

Table 2

Distribution percentage

Year	Regions	Total samples/year	Distribution of Vincamine			
			0—0.49		0.5—0.99	
			p*	%	p	%
1962	Nyugat-Dunántúl (West-Transdanubia)	12	—	—	6	50.—
1963		10	1	10.—	2	20.—
1964		11	2	18.2	4	36.4
1962	Dél-Dunántúl (South Transdanubia)	10	2	20.—	8	80.—
1963		11	4	36.4	6	54.6
1964		8		—		—
1962	Dunántúli Középhegység (Transdanub. Middle Mounts.)	10	3	30.—	3	30.—
1963		9	2	22.2	4	44.5
1964		2	1	50.—	1	50.—
1962	Kis-Alföld (Little Plain)	4		—	2	50.—
1963		7	2	28.6	1	14.2
1964		4		—	1	25.0
1962	Dunavidék (Danube Distr.) ...	3		—	1	33.3
1963		6	1	16.7	1	16.7
1964		2		—	1	50.—
1962	Duna-Tisza köze (Territory between the Danube and Tisza) ..	7	1	14.2	4	57.2
1963		1		—	1	100.—
1964		3		—	3	100.—
1962	Tiszántúl (Territory of the river Tisza)	11	2	18.2	5	45.4
1963		8	2	25.0	3	37.5
1964		8		—	7	87.5
1962	Nyírség (Nyírség-District). ...	3	1	33.3	2	66.7
1963		2		—		—
1964		5		—	3	60.—
1962	Északi Középhegység (Northern Middle Mounts.)	27	2	7.4	18	66.7
1963		16	4	25.—	6	37.6
1964		12	2	16.7	7	58.4

p* = number of samples

of Vincamine

values within %value limits

1.0—1.49		1.5—1.99		2.0—2.49		2.5—2.99		3.0—<	
P	%	P	%	P	%	P	%	P	%
6	50.—		—		—		—		—
2	20.—	2	20.—	1	10.—	1	10.—	1	10.—
4	36.4	1	9.—		—		—		—
	—		—		—		—		—
1	9.—		—		—		—		—
7	87.5		—	1	12.5		—		—
3	30.—	1	10.—		—		—		—
3	33.3		—		—		—		—
	—		—		—		—		—
2	50.—		—		—		—		—
2	28.6		—	1	14.3		—	1	14.3
2	50.—	1	25.—		—		—		—
2	66.7		—		—		—		—
2	33.3		—	2	33.3		—		—
1	50.—		—		—		—		—
2	28.6		—		—		—		—
	—		—		—		—		—
	—		—		—		—		—
4	36.4		—		—		—		—
2	25.0	1	12.5		—		—		—
1	12.5		—		—		—		—
	—		—		—		—		—
2	100.—		—		—		—		—
2	40.—		—		—		—		—
5	18.5	2	7.4		—		—		—
3	18.7	2	12.5		—	1	6.2		—
1	8.3	1	8.3	1	8.3		—		—

Table 3
Distribution percentage of Vincamine

Year	Distribution percentage of Vincamine			Total
	0-1	1-2	2-3	
1962	60	27	0	87
1963	40	23	7	70
1964	32	21	2	55
Total:	132	71	9	212

$$\chi^2(4) = 10.796; P < 5\%$$

Table 4
Distribution percentage of Vincamine

Region	Distribution of Vincamine values %			Number of samples, total
	0-1	1-2	2-3	
West of the Danube	59	42	8	109
East of the Danube	73	28	2	103
Total:	132	70	10	212

$$\chi^2(2) = 7.273; P < 5\%$$

Table 5
Distribution percentage of Vincamine

Year	West of the Danube				East of the Danube			
	Vincamine values %			Total number of samples	Vincamine values %			Total number of samples
	0-1	1-2	2-3		0-1	1-2	2-3	
1962	25	14	0	39	35	13	0	48
1963	24	12	7	43	16	10	1	27
1964	10	16	1	27	22	5	1	28
Total:	59	42	8	109	73	28	2	103

$$\chi^2(4) = 12.64; P < 5\%$$

$$\chi^2(4) = 31.55; P < 0.1\%$$

Acknowledgement

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VARIABILITY OF QUANTITATIVE CHARACTERS IN MAIZE AS AFFECTED BY GAMMA IRRADIATION

By

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Air-dried kernels of the C5 maize line after inbreeding for several years were treated with 5000 R and 15 000 R of acute gamma irradiation.

In the M_1 generation anomalies of growth and development, so called "radio-morphoses", were observed. In the M_2 generation the variation of the quantitative characters increased following irradiation, as compared with the non-irradiated population.

Study of the relative distribution of frequency of the quantitative characters revealed that 5000 R increased the proportion of the plus variants more than 15 000 R.

The wider variation range in the M_2 generation compared with the control also appeared in M_3 . In M_3 the 15 000 R dosage also increased the variation for some characters.

Introduction

The usability of mutation induction in plant breeding has aroused the interests of specialists in genetics and breeding in our time. A number of comprehensive studies have appeared recently on the principles, methods and results of gene mutation (DUBININ 1961, GAUL 1956, GUSTAFSSON 1947, HOFFMAN 1959, PRAKKEN 1959, SMITH 1958). Research has been directed mainly toward the induction of macromutations in order to change qualitative characters of self-pollinating plants. According to SCOSSIROLI (1963), BÁLINT (1964) and GAUL (1964) micromutations are more important for the breeder than macromutations, particularly if the changed characters concern quantitative traits. The possibility of making use of micromutations was raised for the first time by GREGORY (1956) who, in his experiments with *Arachis*, gave evidence that the variation of quantitative characters can be increased by radiation as compared with non-irradiated population. Similar results have been obtained by CAUL (1956), RAWLINGS et al. (1958), ARMSTRONG (1959), SWAMINATHAN et al. (1962) and EHRENBERG et al. (1964).

According to some observations (ALIKHANJAN 1962, AMER-HAKEEM 1964, SCOSSIROLI 1963) lower doses can be in some cases more effective in changing the quantitative characters than higher ones. Therefore, the probability of occurrence of vital mutations and the chance for the selection of useful mutants, increases.

The purpose of this report is to present data concerning whether or not acute gamma irradiation of maize kernels changes the variability of the quantitative characters of the M_2 and M_3 generations; and whether a 5000 R or 15 000 R exposure would induce more positive changes.

Material and Methods

Air-dried seeds of C5 maize, which had been obtained after several years of inbreeding in USA, were irradiated with 5000 R and 15 000 R of acute gamma radiation at the Central Research Institute of Physics in Budapest. The mutagen treated seeds were planted in the trial plots of the Department of Plant Breeding of the University of Agricultural Sciences, two weeks after irradiation, in medium heavy forest soil with 80×40 cm spacing. In each treatment 30 selfed ears of M_1 were used to produce the M_2 generation and 30 selfed ears of M_2 to produce the M_3 generation. Survey of the data on quantitative characters was carried out after completion of flowering or harvesting except for the M_1 generation. Observations were carried out on 160 plants in the M_2 generation and on 280–300 plants in the M_3 generation.

The Kjeldahl method was adopted to determine protein content on seeds. The total nitrogen content of the homogenized samples was measured with the photometer (Uvifot or Pulfrich's) after sulfuric acid digestion. This value was multiplied by the 6.25 factor in order to express the protein content of the samples in percent.

Results

A. M_1 generation

The primary effects of irradiation were: retarded germination and inhibition of growth and development (Fig. 1). Also a high mortality of seedlings was noted. Various morphological anomalies known from literature

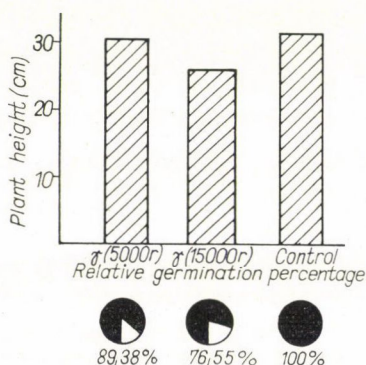


Fig. 1. The primary effects of gamma irradiation on percentage of germination and plant height (4 weeks of age)

[14, 17] (i.e., branching pattern, tapering leaf, disturbance in chlorophyll synthesis etc.) were observed which may be described as non-heritable phenomena known as “radiomorphoses”.

B. M₂ generation

For the evaluation of variability of quantitative characters, first of all the mean values (\bar{x}) and the variation coefficient ($S\%$) were determined. Under the influence of irradiation, except for the leaf number and the number of paired seed rows, the value of the variation coefficients was increased by 5000 R but was not affected by 15 000 R (Table 1).

Table 1

The effect of gamma irradiation on the mean values of quantitative characters (\bar{x}) and their variation coefficients ($S\%$) in the M₂ generation ($n = 160$)

Character	Treatment					
	5000 R		15 000 R		Control (untreated)	
	\bar{x}	$S\%$	\bar{x}	$S\%$	\bar{x}	$S\%$
Plant height (cm)	193.40	11.53*	192.00	9.01	193.00	8.39
Number of leaves	12.06 ⁺	10.36	11.23 ⁺	11.21	11.77	11.77
Number of paired seed rows	18.22 ⁺	11.41	17.04	13.73	17.28	13.77
Ear weight (g)	154.10 ⁺	37.24*	121.90 ⁺	35.60*	140.70	25.57
Ear length (cm)	17.03 ⁺	14.85*	15.82	12.01	16.02	12.67
Protein per cent**	12.48 ⁺	19.71*	12.67 ⁺	13.41	11.43	14.52

** Number of observations ($n = 80$)

⁺ Significant at 0.05 level by comparison with mean value of control.

* Significant difference by F-test at 0.05 level.

In Fig. 2 the frequency distribution of plant height, ear length, ear weight and per cent of protein content is represented. At 5000 R a positive shift of the variation occurred, while at 15 000 R the appearance of positive variants can be observed, only with respect to protein content as compared to the control.

C. M₃ generation

In the M₃ generation the situation is very similar. Eight characters exhibited significant differences between the variation coefficients of the control and the 5000 R dose. Variation ranges are approximately the same as in the M₂ generation (Table 2). In contrast to the M₂ generation, variation concerning leaf number and number of paired seed rows also increases following exposure to 5000 R.

At 15 000 R an increase of variability in relation to the non-irradiated controls is observed in plant height, ear height, mean length of internodia and number of tassel branches although the effect with respect to all but the

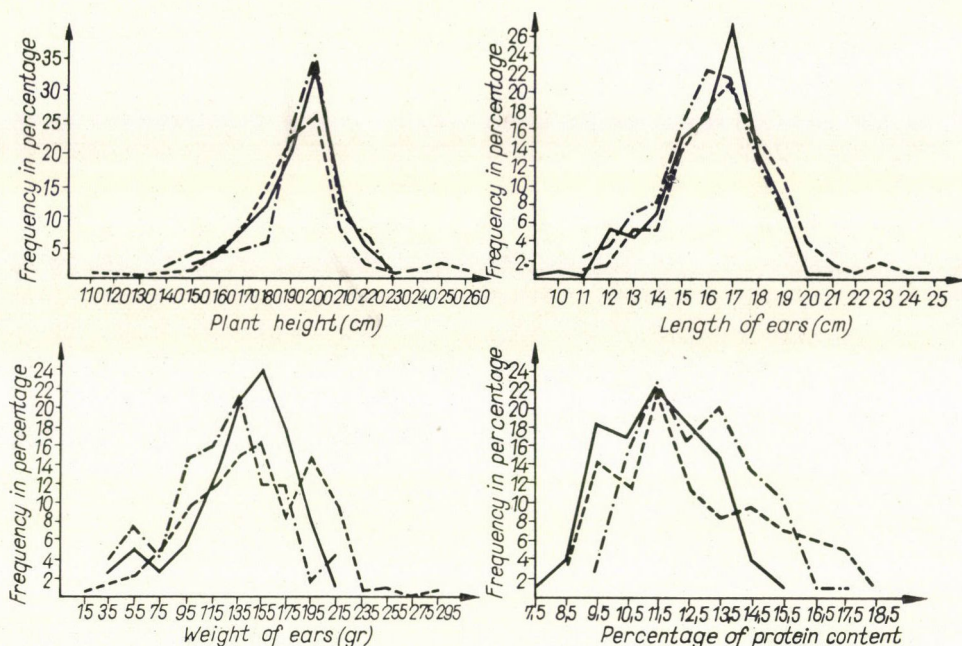


Fig. 2. The effect of gamma irradiation on the distribution on the value of different quantitative characters in the M_2 generation

— = control, - - - - = 5000 R, - · - · = 15 000 R

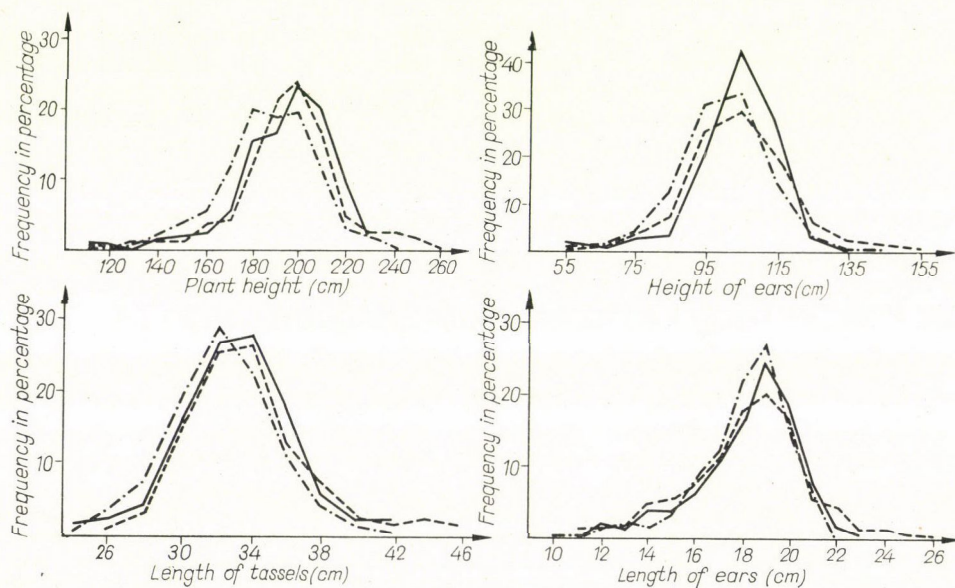


Fig. 3. The effect of gamma irradiation on the distribution on the value of different quantitative characters in the M_3 generation

— = control, - - - - = 5000 R, - · - · = 15 000 R

Table 2

The effect of gamma irradiation on the mean values of quantitative characters (\bar{x}) and their variation coefficients (S%) in the M_3 generation ($n = 280-300$)

Character	Treatment					
	5000 R		15 000 R		Control (untreated)	
	\bar{x}	S%	\bar{x}	S%	\bar{x}	S%
Plant height (cm)	202.38	12.05*	193.38 ⁺	11.13*	200.78	9.99
Number of leaves	11.72 ⁺	9.22*	11.05	8.32	11.16	7.08
Number of paired seed rows	17.25 ⁺	13.39*	16.92 ⁺	10.17	16.32	10.29
Ear length (cm)	18.09	16.75*	18.12	10.93	18.08	12.02
Ear height (cm)	106.40	14.31*	101.93 ⁺	12.10*	106.04	9.89
Mean length of internodium (cm)	12.48 ⁺	23.27*	12.59 ⁺	13.19*	13.07	11.11
Number of tassel branchings	16.67	35.40*	16.62	36.13*	16.35	32.72
Length of leaf (cm)	77.01	8.47	74.67 ⁺	8.99	76.42	8.91

⁺ Significant at 0.05 level by comparison with mean value of control.

* Significant difference by F-test at 0.05 level.

latter is not so pronounced as following 5000 R. Fig. 3 represents the positive change of the variation range of four quantitative characters at 5000 R as compared with the untreated controls. At 15 000 R the positive change was insignificant.

Discussion

Induction of micromutations by irradiation is of practical value because after mutagen treatment it becomes feasible to increase the variation of the basic material of breeding. It is difficult to find the maximum mutation rate specific for each character as many modifying factors are involved from the induction of mutation until the development of the mutant character. The results presented seem to indicate that the variability of quantitative characters can be increased with irradiation. In our case there was a significant increase of variation following 5000 R compared with control which, considering the appearance of plus variants, is a very significant result. The observed wide variation range in the M_2 generation following 5000 R manifested itself in the M_3 generation too; in the case of some characters, there was an increase of variation in the M_3 generation after 15 000 R which had not occurred in the M_2 generation. The results presented lead to the conclusion that, for the induction of useful micromutations and for the widening of variation range in the quantitative traits, the 5000 R exposure is more suitable than the 15 000 R one. In the present case 5000 R is the better dose keeping in balance the utility of the micromutations and the damage which occurred in the population as result of the mutation load.

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EFFECT OF A PROTEIN DIET DURING SUCKLING ON THE SUBSEQUENT PERFORMANCE AND CARCASS QUALITY HUNGARIAN YORKSHIRE PIGS

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I studied the effects of digestible proteins fed to Hungarian Yorkshire pigs in differing quantities from 30 days of age until 70-80 days and from then until a live weight of 110-120 kilograms was reached. Both experiments have showed that carcass quality is highest with a diet containing moderate amounts of protein for pigs up to 70-80 days of age and afterwards with a diet of abundant protein. These pigs with an identical intake of protein have produced approximately 6% more lean* than otherwise.

Introduction

Today a significant effort is being made by animal breeders throughout the world to evolve principles and methods for satisfying the increasing protein needs of the population by increasing the amount of meat produced. In addition to defining the inherited traits, this requires the study of early growth, intensive muscle development and the intake of dietary proteins.

The protein supply necessary for the increase of muscle development has been studied during the last few decades but our knowledge in certain aspects of the question still leaves something to be desired. For example we are still not sufficiently familiar with the effect of protein intake before and immediately after weaning on later performance and on carcass quality. A direct consequence of this lack of knowledge is that with the available dietary protein pigs produce less meat than they should.

Being fully aware of the economic significance of the question I experimented to find a favourable proportion for feeding digestible protein from suckling until the end of fattening. For this reason I concentrated on the effect on final performance of different amounts of protein intake before and immediately after weaning the pigs.

The majority of researchers studying these problems (KERTÉSZ and co-workers 1959, SCHLEGEL-RITTER 1960, LUCAS 1961, NIGUL 1961, BLAIR 1961 and SEWELL and co-workers 1961) examined only the effects of different planes of feeding on the growth of suckling pigs only. Only BOAZ-ELSLEY

* In all instances lean is understood as the amount of lean meat together with bone.

(1962) collaborated on such experiments in which pigs weaned at 10 lb. live weight (4.53 kg) were fed in such a way that they should reach 50, 40 and 30 pounds (22.15, 18.12 and 13.59 kg) until 56 days of age. From the 56th day every pig continued to be fattened until a live weight of 200 lb. was reached.

The pigs were removed from the sow when reaching 50 lb. and at the age of 168.6 days they weighed 200 lb. Those weighing 40 or 30 lb. at the time of weaning attained this weight at 176.6 or 182.1 days respectively. The increase of weight at 56 days of age (from 30 to 50 lb.) required an increase of feed allowances from 3.06 to 3.24 lb. in order to gain 1 lb., but the weight at 56 days did not substantially affect carcass quality.

Material and Methods

During two experiments conducted in 1963 and 1964 I studied the effect on later performance of feeding different amounts of dietary proteins to Hungarian Yorkshire pigs before and immediately after weaning.

For the first experiment I selected 14 litters of pigs (2 each from 7 boars) from the stock of the Herceghalom Experimental Farm kept at Mórismajor. To suit the purposes of the experiment I separated all the litters into two groups each containing one of the two litters out of every boar. The litters selected for the experiment had to reach the age of 30 days. The number of pigs in the groups, the average weight of the litters and of the individual animals at 30 days of age are given in Table 1.

Table 1
Number and average weight of the pigs

	Group 1	Group 2
No. of pigs in litter:		
total:	57	57
average:	8.14	8.14
Average weight of litters:	61.23	62.63
Average weight of pigs:	7.52	7.69

Table 2
Diet

	Group I	Group 2
Ground barley	60%	40%
Ground maize	30%	25%
Milk powder (Skimmed)	5%	30%
Alfalfa meal	5%	5%

The composition of the diets for each group is described in Table 2. One kilogram of feed for Group 1 contained 741 grams of starch value and 86 grams of digestible proteins, while Group 2 received a mixture containing 767 grams of starch value and 148 grams of digestible protein. The difference in the protein-content of the two mixtures was 62 grams per kilogram or 72.09%. Each mixture was supplemented with 2% ground limestone and 0.5% salt too.

I weaned the pigs at 60 days of age after which time they remained in their original pen. After weaning they received the described diet mixture up to 80 days of age, but the feed of Group 2 was supplemented by a solution of powdered skimmed milk amounting to 17 decagrams (1.41 liters) per pig.

I believe this additional protein allowance was necessary in order to achieve the maximum weight possible for the piglets at 80 days of age.

On the 80th day I selected 30 of each group for further feeding. Both groups of 30 were subdivided into groups of 15 containing a counterpart with identical origin, sex and nearly identical development.

The mean weights of the groups, their standard deviation as well as the proportion of animals of each sex are given in Table 3.

Table 3
Mean weight, standard deviation, sex

Group	No. in group	Males	Females	Average weight, Kg.	Standard deviation Kg.
II.A	15	7	8	24.93	± 2.51
II.B	15	8	7	25.00	± 2.91
I.C	15	6	9	18.66	± 3.29
I.D	15	6	9	18.63	± 2.92

For my second experiment I selected 10 litters which I divided into 2 groups on the basis of proportion of each sex and weight at 30 days of age.

	Group 1	Group 2
Number of pigs	40	43
Average weight	6.68	6.62

The pigs of each group received a mixture of 60% ground barley, 30% ground maize, 5% powdered milk and 5% alfalfa meal which was supplemented with 2% ground limestone and 0.5% salt.

In addition to this diet the pigs of Group 2 had a freshly prepared solution of dried skimmed milk 4 times daily (1 liter of water to 12 decagrams of powdered milk). The quantity of milk consumed per pig per day was 2.5 liters at most.

The pigs of both groups were kept in the same indoor pen with an outdoor run. They consequently ate the same feed but at the time of giving the milk solutions the different groups were separated and one group distinguished by paint markings on their backs. Undoubtedly these separations four times a day might be harmful for the growth of the pigs, but I could find no other way of maintaining identical environmental conditions. This problem did not occur in experiment 1 but there the origin from different sows represented a disturbing variable which had to be reckoned with.

The pigs in the second experiment were weaned at 60 days, but the pigs kept in the pens were on the described diet until 70 days of age. Then I selected 30 pigs of each group for studying later performance. The selection from the litters was undertaken according to the principles described in experiment one and thus here I again had both groups subdivided into 15-member

Table 4

Mean weight, standard deviations and proportions of animals of each sex in the second experiment

Group	No. in group	Males	Females	Average weight, kg	Standard deviation kg
II.A	15	7	8	17.90	2.39
II.B	15	7	8	17.83	2.32
I.C	15	10	5	13.13	1.81
I.D	15	8	7	13.07	1.66

units each containing individuals having counterparts with identical origin, sex and nearly identical performance.

Table 4 includes the mean weights, standard deviations and the proportions of the animals of each sex.

The diet of the pigs during the fattening period of the experiment was composed of 60% ground barley, 28% ground maize, 20% alfalfa meal and 2% soyabean flour. For the mentioned subgroups I provided a prescribed amount of powdered milk. Thus for those animals between 30 and 110 kg. the average quantity of digestible protein consumed was the following:

Group A: abundant protein supply up to 70–80 days then an average amount of c. 219–224 g. (in accordance with Hungarian prescribed standards).

Group B: abundant protein supply up to 70–80 days, afterwards an average amount of c. 196–198 g. (10.5–11.7% less than that of Group A).

Group C: moderate protein supply given up to 70–80 days, then this group was given the same feed as Group A.

Group D: moderate protein supply given up to 70–80 days, afterwards the intake averaged between 246 and 256 g. (13.8–14.8% higher than that of Group C).

This arrangement was expected to answer whether pigs receiving an abundant supply of protein during the suckling period — and consequently stimulated to develop muscles faster — could be kept on a substandard amount of protein during the period of fattening. I also wanted to learn whether pigs receiving a lower amount of protein during the suckling period will give a better performance corresponding to the higher intake of protein given during the fattening period.

The pigs kept in the sties set up for individual experiments were fed until reaching a live weight of 110 kg. during experiment I, while those of the second experiment — for technical reasons — until reaching a live weight of 115–120 kg.

Every pig was slaughtered at the end of the experiment and complete carcass quality studies were made.

Results and Discussion

In experiment I the average weight of pigs in Group 1 (fed on a low-protein diet) was 16.0 kg at 80 days of age, i.e., their weight at 30 days of age (7.52 kg) was increased by 8.47 kg or 112.63% until the 80th day. In contrast to these the weight of pigs fed on a high-protein diet averaged 21.84 kg at 80 days of age. Thus pigs weighing 7.69 kg at 30 days of age showed a weight gain of 14.4 kg or 183.87%. The difference in weights at the 80th day amounted to 5.84 kg or 36.50%. The average daily weight gain between the 30th and 80th days was 169 grams for the first group and 283 grams for the second during the same interval.

Examining the feed conversion efficiency of the individual groups I discovered that the pigs in Group 1 had produced a 1 kg weight gain from 2823 grams of starch value and 328 grams of digestible proteins, while those of group 2 had gained the same amount from 2165 grams of starch value and 456 grams of digestible proteins. The pigs in Group 2 on a high-protein diet had consumed 658 grams or 23.31% less starch value than the others but the digestible protein intake had been increased by 128 grams or 39.02% in order to achieve the same weight gain.

Group 1 in the second experiment was fed on a low-protein diet and attained an average weight of 12.94 kg at 70 days of age. Thus their weight at 30 days (6.62 kg) was increased by 6.32 kg or 95.46%. Conversely the pigs fed on a high-protein diet (Group 2) averaged 17.72 kg at 70 days of age, i. e. from 30 days of age their weight rose to 11.04 kg from 6.6 kg (165.27%). At 70 days of age the difference was 4.78 kg or 36.94%. The average daily weight gain between the ages of 30–70 days was found to be 158 grams in case of the first group and 276 grams for the second.

The pigs in Group 1 which had been given only the feed mixture gained 1 kg of weight from 1556 grams of starch value and 181 grams of digestible protein. The milk powder could be separately given and the pigs fed on such a high protein diet required 1389 grams of starch value and 294 grams of digestible proteins in order to produce 1 kg of weight gain. Naturally this latter group produced the weight gain of 1 kg with 167 grams or 10.74% less starch value but with 113 grams or 62.43% more digestible protein.

Table 5

Daily weight gain and feed conversion

Group	Age upon reaching 110 kg	Average daily weight gain		Starch value needed for 1 kg weight gain	
		g	index	g	index
Experiment 1					
A	231.0	597	100	2819	100
B	250.0	535	89.6	3132	111.1
C	254.9	569	95.3	2919	103.5
D	237.1	628	105.1	2724	96.6
Experiment 2					
A	234.4	600	100	2888	100
B	256.9	536	89.3	3179	110.1
C	254.8	580	96.6	2976	103.0
D	239.7	622	103.6	2887	100

The described quantity of digestible protein produced the weight figures given in Table 5 for pigs between 30 and 110 kg.

The effect of the different protein allowances given until for 70 or 80 days was noticed even during the fattening period. In the fattening period the pigs between 30 and 110 kg, that had received a high-protein diet at the age of weaning and had been given identical amount of protein during the fattening period as the pigs of groups C, in both experiments had a higher daily average weight increase than the rest of the animals. Thus their daily weight gain in experiment 1 was 28 grams (4.92%) higher and in experiment 2 20 grams (3.45%) higher than those in the C groups. Perhaps these differences were not significant in both instances, but since both experiments yielded identical results (Group A showed the greater gain in each case) it seems logical to presume that the greater weight increase during the fattening period is the result of the higher protein allowance given until 70–80 days of age and the consequent increased growth is the result of the greater protein intake. In accordance with the greater increase of weight the feed conversion efficiency of these groups was better although not significantly so.

The data on the fattening of the B groups have given a definite answer to the question whether the pigs receiving a high protein diet until 70–80 days of age, and consequently induced to have a speedier muscle development, could be satisfied with the smaller standard amount of protein during the fattening period. These groups that during the fattening period, received 10.5% less digestible protein in experiment 1 and 11.7% less in experiment 2 than group A had a considerably lower daily weight gain than the others. The difference of those in experiment 1 to Group A was 62 grams (10.39%) while in experiment 2, 64 grams or 11.94%. Due to the smaller weight increase these pigs reached the weight of 110 kg 19 days later than the others in experiment 1 and 22.5 days later than those in experiment 2. Their feed conversion efficiency was also significantly lower than the others.

These groups receiving a low-protein diet until 70–80 days of age and then only a standard amount of protein during the fattening period showed a significantly lower weight gain than the C groups (34 grams or 6.35% less in experiment 1 and 44 grams or 8.21% less in experiment 2). Consequently they gradually lost the advantage in weight gained before and immediately after the weaning period and because of the significantly worse feed conversion efficiency they reached a weight of 110 kg at approximately the same age as Group C.

Comparing Groups C and D it has become clear that it is still worthwhile to provide a high protein diet for pigs that received a relatively small amount of protein until 70–80 days of age. In experiment 1 Group D consumed 13.8% and in experiment 2, 14.8% more digestible proteins. Under the effect of extra protein the daily weight gain of the pigs in Experiment 1 and 2 signifi-

cantly increased (59 grams, i.e., 10.37% and 42 grams of 7.25% respectively). At the same time their feed conversion efficiency improved — although not significantly. Due to the greater weight gain they reached 110 kilograms in 17.8 and 15.1 days respectively.

Group D presents a favourable picture even in comparison to Groups A which had a good supply of proteins from the time of suckling. During the period of growth their weight gain was greater than that of Groups A; thus their daily weight gain in experiment 1 was 31 grams (5.19%) and in experiment 2, 22 grams (3.66%) more than in the compared group. The difference between the two groups was significant only in the first experiment although the feed conversion efficiencies were practically the same. These favourable weight increases allowed the pigs of Groups D to gradually make up their losses until they reached the age of 70 or 80 days and they attained a weight of 110 kg only 6.1 or 5.3 days later.

These data have convinced me that it is possible to make up for the weight losses caused by a low-protein intake during the very early periods.

Table 6
Carcass quality data

Group	No.	Live weight before slaughter, kg	Length of carcass, cm	Average thickness of back fat, mm	Lean %	Ham %
Experiment 1						
A	14	108.3	100.1	41.6	58.38	17.49
B	14	109.8	99.0	43.4	56.49	16.86
C	14	110.2	98.5	42.7	58.14	17.54
D	15	109.7	99.3	39.9	59.77	18.23
Experiment 2						
A	14	113.1	98.8	42.6	57.23	17.07
B	15	113.5	100.3	43.8	56.72	16.98
C	15	114.5	100.6	44.9	57.42	17.06
D	15	114.0	100.8	42.9	58.52	17.39

The important carcass quality data are given in Table 6.

The most favourable proportion of lean to fat (58.52—59.77%) was found in the D groups of both experiments which were fed a low protein diet until 70—80 days of age but afterwards received above-standard protein allowances. Although the differences between Groups A and D were not significant for the amounts of lean, the congruent data of both experiments allow us to presume that the relatively moderate growth during the very early period followed by a greater increase in weight due to the increased amount of protein

given during the later growth period is favourable for the development of muscle.

As far as carcass quality is concerned it was found detrimental for growth to give large amounts of protein to animals under 70—80 days of age, while a low protein diet (groups B) during the fattening period. The proportion of lean in these pigs was 3.28—1.80% less than for those of the D groups. As far as experiment 1 is concerned this is a direct result of the feeding method of D which provided 2.81 kg more lean. In the same experiment the weight of the hams of group D was 1.2 kg higher.

After obtaining the results of growth rate and carcass quality, it can now be asked, "Which protein diet is more profitable for feed conversion?" The question is unambiguously answered by the data for each group on the amount of feed consumed from the age of 30 days until achieving a live weight of 110 kg (Table 7).

Table 7
Feed consumption

Group	Experiment 1		Experiment 2	
	Starch value kg	Digestible protein kg	Starch value kg	Digestible protein kg
A	265.95	37.37	269.36	36.93
B	293.19	37.47	296.34	36.79
C	279.15	36.72	280.67	37.44
D	260.34	37.59	269.74	39.53

From all these data it becomes clear that independent of the daily protein intake, the pigs consumed — on the average — an almost identical amount of protein until attaining a weight of 110 kg. But the animals in groups A and D made an even more efficient use of starch value than did those in the B groups in particular.

Conclusions

The author has examined the protein conversion efficiency throughout the entire life-span of the pigs. During this process he attempted to determine whether pigs receiving a high-protein diet around suckling and certainly having a higher rate of muscle development could be fed on a sub-standard amount of protein (10.5—11.7% less) during the fattening period. On the other hand he examined whether it would be advantageous to give an increased protein supply (13.8—14.8% higher) to pigs during fattening which had received a moderate protein supply around the suckling period.

The data of the two experiments answer the first question in the negative. The pigs receiving a high protein diet until 70 or 80 days of age showed because of the reduced protein intake a 10.39—11.94% reduction in their daily weight increase and a significantly worse feed conversion efficiency during their growth from 30—110 kg. The amount of lean in the carcasses of these pigs was in all instances less than in the other groups.

The pigs kept on a moderate protein diet until 70—80 days of age but receiving a high amount of protein during the fattening period almost caught up with the others in growth by the time they reached a weight of 110 kg and at the same time they produced more lean than any other group.

From the results of my experiments it can be concluded that in order to increase the amount of lean that the Hungarian Yorkshires are capable of producing — especially when bacon and ham production are of the high concern and carcass quality is of crucial importance — the suckling pigs must receive such a protein diet that may — until 60 days of age — result in healthy growth without excess fat. Consequently at this age the desirable weight for weaning is 14—16 kg.

On the other hand during the growth following weaning 15% more protein than that prescribed in the standard formulas must be fed to the animals. By such a procedure 6000 kg more lean can be produced per year from a breeding stock of 300 sows. In other words lean meat production can be raised by 6% with an identical amount of protein computed over the entire lifespan of the pigs for slaughter.

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TRANSPLANTATION OF A PART OF THE BERRY FRUIT OF *SOLANUM MELONGENA* L.

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We have studied the transplantation of a part of the berry fruit of the polyspermous fruits on the various eggplant (*Solanum melongena* L.) varieties. We have discovered that it is possible to successfully transplant a part of the polyspermous fruits of another plant. The transplanted fruits begin to grow and the seeds in them ripen; if these seeds are sown they germinate and depending on the transplantation the properties of the offspring change. Older transplanted plants do not grow nor do they grow if the transplantation or rather the cut perpendicular to the axis of the fruit was made in the apical section of the fruits where the seeds are located.

Introduction

Generally buds (*gemma*) and shoots are the parts of the plant used to be transplanted, i.e., when a living component of one plant is replanted on the cut surface of another plant. There is a very extensive literature for such types of transplantations or rather on their methods, growth and also of their compatibility or incompatibility. A lesser number of researchers treated the transplanting of other plant organs. For a while the transplantation of the fruits or rather of a part of them had been an inconceivable task, so no attention was paid to it. There is only a small amount of data available in the literature. According to RZSAVITYIN (1960) only NAZAROV (1953, 1954) did fruit transplantations on the *Cucurbita pepo* L. i.e. on the squash. He has stated that if the two components, i.e. the one on which we transplant and the other we do transplant have an identical rate of growth, then the transplanted fruits will begin to grow, otherwise they will not.

According to the author the fruit used as scion must be two-thirds (of the entire fruit) while that used as the stock must be one-third. If the transplanting is done by a cut parallel to the longitudinal axis of the young fruits there will be less success than if the cut is made perpendicular to the axis.

In our examinations we were trying to solve the following problems:

1. Can part of the fruit be transplanted on another one?
2. Can the seeds formed in the transplanted fruit germinate and are the sprouted plants productive?
3. Can the change be examined in the offspring in relation to the two varieties?

Material and Methods

The plant used in the experiment was the *Solanum melongena* L. i.e. the eggplant. We used two varieties of the *Solanum melongena* L. species. According to FILOV's (1958) system they are as follows: *S. melongena* L. ssp. *occidentale* Haz. var. *bulgaricum* Fil. (or violet eggplant) and *S. melongena* L. ssp. *subspontaneum* Fil. var. *leucoum* Alef. (or white eggplant).



Fig. 1. The fitted fruit held with rubber bands



Fig. 2. Isolation of the transplanted fruits

The fruit of the violet eggplant variety has the following characteristics: it is pear-shaped or elliptical; exocarpium is violet; mesocarpium is green; the thin-walled cells of the endocarpium are also green. Fruits are large and when being ready for market they are violet and being fully ripe they are brown.

The fruit of the white eggplant variety has the following characteristics: it is ovoid and exo-, meso- and endocarps are all white. Fruits are small and when they are ready for market they are white, turning yellow when fully ripe.

The transplantation was done when the developing fruit was approximately 2–3 cm tall. The petals had already fallen off, while the sepals tightly stuck to the fruit. The trans-

plantation itself was done on the basal section of the fruit on the stock. With a single cut perpendicular to the longitudinal axis of the fruit and 1 or 2 cm from the pedicle, two-thirds of the fruit was removed. The two-thirds of fruit was fitted to the one-third left on the stock which was generally and on the whole developed to the same extent. The size and shape of the surface of the cut was identical with the cut on the fruit of the stock. After the fitting, we



Fig. 3. Ripening fruits



Fig. 4. White eggplant transplanted on itself. At time of ripening

fastened the two parts with a slightly tight rubber band (Fig. 1). The fruit composed of two parts held together by a rubber band was put under a cellophane isolator (Fig. 2) in order to assure the constant and large relative moisture content. After the fruits became ready for market we removed the isolators (Fig. 3). The fruits ripened without them. The fully ripened fruits were harvested, their characteristic data recorded and the number of seeds in the fruit counted. The seeds that had developed in the transplanted fruits were planted next year: we noted the extent of their germination, the productivity of the sprouted plants and also whether there were any changes observable in the offspring (in comparison to the two varieties).

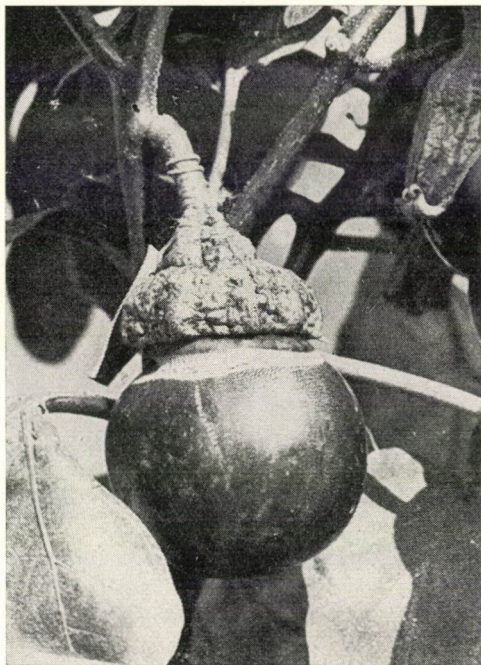


Fig. 5. Violet eggplant transplanted on itself. At time of ripening



Fig. 6. White eggplant transplanted on Violet eggplant. At time of ripening

During our experiments the transplantations were done in a greenhouse. The seeds developed in the transplanted fruits were planted in a hot bed while the sprouted plants set out in the field.

We had four combinations: first when the fruits of the White eggplant and the Violet eggplant varieties were transplanted on themselves (Figs. 4 and 5), when the White eggplant was transplanted on the Violet eggplant and when the Violet eggplant was transplanted on the White eggplant (Figs. 6 and 7). We planted 20 to 30 plants of each combination.



Fig. 7. Violet eggplant transplanted on White eggplant. At time of ripening

Results

The results gained during the experiments can be divided into four groups: *a)* working out of the methods of transplantation; *b)* examination of the new growth and productivity of the transplanted fruits; *c)* the germination and viability of the seeds in the transplanted fruits, and *d)* the evaluation of the changes experienced in the offspring.

a) Working out of the transplantation method. We tried several methods of transplantation and the one described above proved to be the most effective. The following statements can be made on the basis of the working out of the methods of transplantation:

1. In case of the transplantation of large fruits advanced in growth the component used as scion does not begin to grow. No scar cambium is formed in the exocarpium and neither is scar tissue formed.

2. If the cut is made perpendicularly to the longitudinal axis of the fruit at the apical portion of the fruits used as stock (i.e., where the seeds are located), no growth takes place and the transplanted section dies.

3. During transplantation the cut always should be made perpendicularly to the longitudinal axis of the fruit on the basal section of both fruits because the growth of the transplants made parallel with the longitudinal axis is inadequate.

4. The size and shape of cut surfaces on the transplanted fruit and on which transplantation is made have to be identical for if not then the transplanted section does not grow.

5. The transplanted fruits held together with rubber bands have to be isolated with a cellophane bag in order to assure a large relative humidity for in the beginning the transplanted section suffers a great loss of moisture.

Table 1

*The degree of growth and yield during the transplantation of part of the fruit
1963—1965*

Combination	No. of transplanted fruits	Growth %	% of productive plants from those which grew	No. of seeds in the transplanted fruits
V/V	26	63.44	100.00	163.63
W/W	25	68.00	100.00	463.88
V/W	66	49.91	100.00	321.25
W/V	55	61.82	88.24	510.20

V = Violet eggplant

W = White eggplant

b) *The examination of the new growth and productiveness of the transplanted fruits.* Regarding the transplanting of a part of the fruit it was questionable to what extent the transplanted fruits would grow, i.e., whether new growth may be taken for an exceptional or a general case.

The data concerning growth may be seen in Table 1. From Table 1 we can see that the growth of the transplants is not an exceptional but a general case because independent of the combinations growth takes place in 50—70% which seems to be quite a good result. The productiveness of transplanted and growing fruits is between 90 and 100%, i.e., the seeds in transplanted fruits continued to grow and ripened. From the data of Table 1 it can also be seen that the number of seeds in transplanted fruits corresponds to that of seeds in the fruits of untransplanted varieties or rather their proportions are similar. Namely in the Violet eggplant variety less seeds are formed than in the White

Table 2

*Germination and viability of the plants sprouted from the seeds of transplanted fruits
1963—1965*

Varieties and combinations	Germination percentage	Productive plants in %
V	70.14	95.00
W	69.65	93.00
V/V	68.89	56.30
W/W	77.08	60.98
V/W	85.87	80.44
W/V	79.00	68.62

V = Violet eggplant

W = White eggplant

variety and this proportion is also observable in the number of seeds being in the transplanted fruits.

c) *The germination of seeds in transplanted fruits and the viability of the sprouted plants.* The ripening of seeds in transplanted fruits is not sufficient to prove the viability of the seeds, whether they can germinate or are shrivelled, unviable ones. In order to test them the seeds developed in transplanted fruits were planted and their percentage of germination stated.

The percentage values of the germinated seeds may be seen in Table 2. From the data of this Table it can be stated that there is no apparent difference between the germination of the seeds originating from transplanted fruits and from the untransplanted ones in regard to the percentage value of germination. This allows us to conclude that the alien component, once newly grown, will be provided with nutrient matter by the stock. It might, however, occur that the seeds developing from the transplanted components germinate but the sprouted plants are not viable or productive. In Table 2 we present the percentage values of productive plants, i.e., what percentage of germinated plants produced fruits containing seeds or rather what percentage of them was productive. From the data of Table 2 we can state that the germinated seeds originating from untransplanted fruits produced a larger number of productive plants (95.00, 93.00%) than did the seeds of transplanted fruits (56.30, 60.98, 80.44, 68.62%).

d) *Evaluation of the changes experienced in the offspring.* In the next year we sowed part of the seeds developing from transplanted fruits and checked the extent of changes in the offspring. The quality and extent of changes are listed in Table 3.

Table 3

Offspring variability of seeds developing in transplanted components during the transplantation of a part of the fruit

Combina- tion	No. of examined grafts	Planted seeds of the examined grafts in %	No. of changed grafts determined from the planted seeds	
			no. 1	%
V/V	14	9.31	0	—
W/W	18	8.27	0	—
V/W	47	3.58	9	19.15
W/V	57	2.90	12	21.05

From the data of Table 3 it can be stated that the transplantation of Violet and White eggplant varieties results in a change in the property of the offspring originating from seeds developed in transplanted components. There are four views about the causes of the change. According to the first seeds

remain in the component on the graft at the time of transplantation, i.e., this is a simple seed mixture. We find this view untenable as we should gain in the first generation only violet and white individuals, whereas transitional and streaked individuals were also obtained. According to the second concept scarring as a mutagenic effect causes in itself the change in the offspring. We believe this is also untenable because no change in offspring is obtained when transplanting the two varieties on themselves. According to the third view the alkaloids characteristic of the *Solanaceae* family, in this particular instance the solasodin, as a mutagenic factor causes a mutation when getting from the stock into the scion. In our opinion this is also unacceptable because both varieties contain solasodin and change occurs even when we transplant the variety with a larger active agent content on varieties with small content. There is a fourth view according to which the metabolism of the stock becomes built into the nutrient supply of the transplanted section. According to the data of our experiments we must accept this last view.

As it may be seen from Table 3 changes occur to a considerable extent in the first generation. Moreover, it is possible that had we planted all the seeds from the grafts changes would have occurred on more grafts and to an even greater extent.

Changes in the colour and shape of the fruit, as most easily assertible alterations, can be experienced. The changes occurring in the colour of the fruit encompass a broad spectrum between the colour of the two varieties. The seeds of the first generation being sown the offspring continue to segregate according to laws unstated so far.

According to our present examination and in agreement with our views it seems undoubtable that underlying changes take place under the effect or interpenetration of metabolic products of the stock in the seeds of the component used as scion when the stock has different properties. These change the uniformity of the offspring and cause a segregation in them. Only future biochemical examinations can clarify the effect of the metabolic change, but the fact of change allows us to assume that probably an underlying change takes place during the course of the metabolism.

Conclusions

In case of transplanting a part of multi-seed fruits, the transplanted fruits used as the scion grow, seeds grow ripe in them and if planted they germinate and in proper transplantation combinations the offspring originating from the seeds in the transplanted components change. Consequently we have to assume that scar cambium can be formed in the exocarpium of the young fruits which results in the growth or "knitting" of fruits. Further histo-

logical examinations are necessary to state the details of the process, how and what scar cambium is formed, how the union of the vascular bundles occur and whether the growth of the transplanted components and of those on the stock is the result of cell division or cell growth. Further physiological examinations are expected to clarify the question of how nutrients are transported at the contact of the two cut surfaces and also whether later all nutrients pass through the scar surface or not (note the reduced productivity of the offspring originating from the transplanted section!). The view that the transportation of nutrients into the transplanted section does not take place and the transplanted fruit continues to develop only from the already existing nutrients of the transplanted section is in our opinion incorrect as the transplanted components reach natural size and because of the changes found in the offspring.

In case of proving the one- or two-directional differential metabolism transport occurring on the two cut surfaces we believe fully proved by direct experimentation, too, the condition and way of changes in the offspring originating from seeds in the transplanted section. In a later study we plan to report on our results gained in the further examination of the histological, physiological and genetical problems involved.

Acknowledgements

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INFLUENCE OF POLYPLOIDY ON THE CHANGE OF THE CONTENT IN SOME CHEMICAL COMPOUNDS IN THE POLLEN OF SUGARBEET

By

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Phosphorus and nitrogen compounds in the pollen of two diploid sugar beet varieties and tetraploids derived from them were studied quantitatively. Pollen was chosen as an object for investigations with an aim to determine the amount of the most important chemical compounds not only per weight unit, but also in individual pollen grains, representing independent functional units.

As a result of this study, we found that diploids and tetraploids show no specific differences with regard to the amount of phosphorus or nitrogen compounds per weight unit of pollen. But the amount of named compounds in the functional unit, i.e. in pollen grain, varies in quite a definite manner with the grade of ploidy. Duplication of the set of chromosomes leads, first of all, to a doubling in the DNA content. Direct proportional relation was also noted as to total RNA, phosphoproteids, lipoids, acid-soluble phosphoric compounds, proteins and non-protein nitrogen compounds.

Such a doubling of the nuclear elements alters relations existing between the nucleus and the cytoplasm. In the course of further life activity the nucleus determines quantitative changes in the metabolic processes. This leads to an increase of cell dimensions and weight, as well as of the number of certain cell structures (plastides, membranes, pores a.o.). Hence, by changing the quantitative relations of the most important chemical compounds of the cell, polyploidy determines changes in the phenotype and physiology of plants.

Introduction

Phosphorus compounds play an important role in metabolism. They participate in many biochemical transformations of utmost importance in nucleus and cytoplasm. With the compounds of phosphorus content such processes of vital importance in the organism are connected as movements of the protoplasm, transportation of substances, respiration. They participate in the transformations of carbohydrates, starch and in the biosynthesis of proteins and fats. Important is the role of phosphorus compounds in the processes of accumulation and transformation of energy necessary for the display of a number of biochemical reactions.

Substances of nitrogen content belong to the nucleoproteids, enzymes, amino acids and together with the nucleic acids are connected with the processes of the formation of cell structures and are their main components.

Polyploidy upsets the established relations between nucleus and cytoplasm. It is well known that unbalanced systems cannot successfully operate. However, the fact that natural and artificially induced polyploids grow and

propagate in a normal way seems to prove that in the cell new equilibria come into being which correspond to the changed chromosome level. It is interesting in this connection to find out whether this reorganization brings about a change in the amount of the most important compounds participating in the metabolism and governing the same.

We have chosen the pollen as object of investigation because pollen grain is a separate functional unit and the isolated condition of the pollen grains and their regular geometrical shape simplify the work of the count of grains contained in the unit of weight.

Besides, there is only one study (KIZELJ 1929) known to us dealing with the investigation of the chemical composition of the pollen of sugarbeet and this dates from the thirties.

Therefore the determination of the quantity of the most important phosphorus and nitrogen containing compounds in the pollen grains of various ploidy seemed undoubtedly interesting.

Material and Method

The object of investigation was the pollen of the diploid varieties Ramonskaya-023, Verhnyachskaya-038, varietal mixture Ramonskaya-023 + Verhnyachskaya-038 + Biyskaya 54 I as well as pollens of their tetraploid analogues obtained in the Department of Genetics and Cytology of the Academy of Sciences of the BSSR.

Fractioning of the phosphorus containing substances was carried out according to the method of OGUR—ROSEN (1950). The amount of phosphorus was determined with the method of FISKE—SUBBOROW (1925) on the photoelectrocalorimeter FEKN-57 with the 657 m μ light filter. The values of phosphorus referred to in the text are the medium results of 4 measurements. Total and protein nitrogen was determined with Kjeldahls micrometer. The non-protein nitrogen was calculated from the difference between total and protein nitrogen.

Results

Polyploidy gives rise to the increase of dimensions and weight of the pollen grains. From Table I it appears that the pollen of diploid varieties is approximately of uniform dimension. The mean diameter of pollen grains in different varieties ranges between the limits of 20.01—20.99 μ , while the diameter of pollen grains of the tetraploid plants fluctuates between 26.66 and 29.82 μ . The comparatively little increase of the diameter causes an increase of 2.2 to 2.9 times in the volume of pollen grains of the tetraploids as compared with the diploids. Thus, if the volume of the pollen grain of diploid amounts to 4195—4842 μ^3 , in the tetraploid it is 9922—13 884 μ^3 . The weight of a tetraploid grain is 1.3 times to twice as great as in the diploid while in one variety (R-023) a multiple increase of the grain weight is observed: (4466 pg*

* pg = pikogramm = 10^{-12} g

Table 1

Characteristics of the pollen of diploid and tetraploid plants of sugarbeet

Variety	Ploidy	Diameter of pollen grain $M \pm m$ MK	Volume of pollen grain $M \pm m$ MK ³	Weight of pollen grain pg*
R-023	2n	20.99 \pm 0.148	4 842 \pm 49	4466
R-023	4n	29.82 \pm 0.313	13 884 \pm 192	9037
V-038	2n	20.01 \pm 0.171	4 195 \pm 42	4289
V-038	4n	26.66 \pm 0.286	9 922 \pm 178	5691
Mixture of varieties	2n	20.77 \pm 0.157	4 691 \pm 45	3760
Mixture of varieties	4n	26.92 \pm 0.246	10 214 \pm 181	5345

* Pikogramm (pg) = 10^{-12} g.

and 9037 pg) and in two other variants the weight increases from 4289 pg to 5691 pg and from 3760 to 5345 pg.

It should be noted that there is some fluctuation in the volume and weight of the pollen grains of diploid plants. This fluctuation may be brought about by insufficient maturity of the single pollen grains or by their unequal moisture content. Varietal differences should naturally be not overlooked either. Volume and weight of the pollen of the tetraploid forms, as we have seen above, change to a substantially higher degree. Higher variability is characteristic of many features of experimentally obtained tetraploids but in the given case beside the movements indicated above, apparently meiotic decompositions took place which are often observed in tetraploids and lead

Table 2

*Phosphorus content in 1 g air-dry pollen
(in mg)*

Phosphorus	Phosphorus content mg					
	R-023		V-038		Mixture of varieties	
	2n	4n	2n	4n	2n	4n
Nucleic acid	1.20	1.06	1.07	1.38	1.26	1.55
a) DNA	0.36	0.33	0.32	0.46	0.36	0.43
b) RNA	0.84	0.73	0.75	0.92	0.90	1.12
Total acid soluble	2.26	2.45	2.52	2.88	3.09	3.27
a) mineral	1.41	1.55	1.32	1.40	1.32	1.40
b) organic	0.86	0.90	1.20	1.48	1.77	1.87
Lipoid	1.05	1.05	1.04	1.08	0.98	1.03
Phosphoproteids	0.34	0.32	0.38	0.36	0.33	0.31
Total:	4.85	4.86	5.01	5.70	5.66	6.16

to the formation of abortive and often entirely empty pollen grains (BRESLAVEC 1963).

In Table 2 the content of various phosphorus fractions is indicated in 1 g air dry pollen.

Nucleic acids. From the Table it appears that the pollen of the diploids contains 1.07–1.26 mg of nucleic acid phosphorus, while the pollen of the tetraploids 1.06–1.55 mg. In the variety R-023 the pollen of the diploid contains more nucleic acid phosphorus than the pollen of the tetraploids while in the variety V-038 and in the varietal mixture it is the other way round.

As regards the DRA and RNA phosphorus content here the above indicated law repeats itself while 1/3 of the phosphorus of the nucleic acids belongs to DNA and 2/3 to RNA.

Table 3
Phosphorus content in one pollen grain
(pg)

Phosphorus	Phosphorus content in pg					
	R-023		V-038		Mixture of varieties	
	2n	4n	2n	4n	2n	4n
Nucleic acid	5.4	9.6	4.6	7.9	4.8	8.3
a) DNA	1.6	3.1	1.4	2.6	1.4	2.3
b) RNA	3.8	6.6	3.2	5.3	3.4	6.0
Total acid soluble	10.1	22.2	10.8	16.4	11.6	17.5
a) mineral	6.3	14.0	5.7	8.0	5.0	7.5
b) organic	3.8	8.2	5.1	8.4	6.6	10.0
Lipoid	4.7	9.0	4.5	6.2	3.7	5.5
Phosphoproteids	1.5	2.9	1.6	2.0	1.3	1.7
Total:	21.7	43.7	21.5	32.5	21.4	33.0

From the Table it appears that polyploidy does not cause any definite change in the nucleic acid phosphorus content in 1 g air dry pollen. However, when related to one pollen grain (Table 3) the differences become easy to understand. So for instance if the pollen grain of the diploid contains 4.6–5.7 pg nucleic acid phosphorus, the pollen grain of the tetraploid contains 7.9–9.6 pg or almost the double quantity. Particularly remarkable is the multiple increase of the amount of DNA phosphorus in connection with the increase of ploidy: 1.6 and 3.1 pg; 1.4 and 2.6 pg; 1.4 and 2.3 pg. A direct relation is found between the number of genomes and the total RNA phosphorus content. The pollen grain of the diploid contains 3.2–3.8 pg of this phosphorus while that of the tetraploid 5.3–6.6.

Total acid-soluble phosphorus. 1 g pollen of diploids contains 2.26–3.09 mg while 1 g pollen of tetraploids 2.45–3.27 mg (Table 2). In all varieties

a tendency can be observed toward some increase of total acid-soluble phosphorus content in 1 g tetraploid pollen. Similarly to the previous case differences become easier to survey when phosphorus content is related to one pollen grain (Table 3). Thus, the pollen grain of the tetraploids contains 16.4–22.2 pg of total acid-soluble phosphorus as compared with 10.1–11.6 pg in the pollen grain of the diploids.

In the given case also a direct relationship can be observed between the increase of the number of genomes and the increased content in the pollen grain of acid soluble phosphorus compounds. This can be particularly readily observed with the variety Ramoskaya-023 (10.1 and 22.2 pg).

As to the mineral part of the acid soluble phosphorus, 1 g of the pollen of diploids contains 1.32–1.41 mg while that of the tetraploids 1.40–1.55 mg. One pollen grain of the diploids contains 5.0–6.3 pg, while that of the tetraploids 7.5–14.0 pg of this phosphorus.

The organic part of the acid soluble phosphorus is distributed as follows: 1 g pollen of the diploids contains 0.86–1.77 mg, while 1 g pollen of the tetraploids 0.90–1.87 mg. In the pollen grain of the diploids 3.8–6.6 pg are found, while in the pollen grain of the tetraploids 8.2–10.0.

Lipoid phosphorus. In 1 g pollen of diploid beet there is 0.98–1.05 mg lipid phosphorus. In 1 g pollen of the tetraploid about the same amount of phosphorus in lipid form is found: 1.03–1.08 mg (Table 2). Converted to one pollen grain tetraploids contain substantially more lipoids and this increase amounts nearly to the double value. The lipid phosphorus content ranges in the pollen grain of lipoids from 3.7 to 4.7 pg and attains in the tetraploids 5.5–9.0 pg (Table 3).

Phosphoproteid phosphorus. In 1 g pollen collected from diploid plants 0.33–0.38 mg phosphoproteid phosphorus is found, while in the same amount of pollen collected from tetraploid plants 0.31–0.36 mg (Table 2). One pollen grain of diploids contains 1.3–1.6 pg phosphoproteid phosphorus while in the pollen grain of tetraploids it increases to 1.7–2.9 pg (Table 3).

It is interesting to note that polyploidy brings about increase in the contents of all forms examined of phosphorus converted into a functional unit, the pollen grain. The total amount of phosphorus in the diploid varieties exhibits little change (21.7 pg; 21.5 pg; 21.4 pg) which cannot be stated about tetraploids (43.7 pg; 3.25 pg; 33.0 pg).

Out of all varieties examined Ramoskaya-023 exhibited best agreement between actual and expected amounts of phosphorus. In this variety the ratio of the amounts of phosphorus in the pollen of the two degrees of ploidy was constantly found to be nearly 1 : 2. In the other variants this relation is often on the 1 : 1.5 level.

Nitrogen. Tables 4 and 5 present the nitrogen content in the pollen of the varieties referred to. From Table 4 it appears that 1 g pollen collected from

Table 4
Nitrogen content in 1 g air dry pollen
 (in mg)

Nitrogen	Nitrogen content in mg					
	R-023		V-038		Mixture of varieties	
	2n	4n	2n	4n	2n	4n
Protein	37.3	33.7	35.2	50.0	45.9	43.9
Non-protein	70.0	7.3	8.1	8.6	10.9	10.4
Total	44.3	41.0	43.3	58.6	56.4	54.3

Table 5
Nitrogen content in one pollen grain
 (in pg)

Nitrogen	Nitrogen content in pg					
	R-023		V-038		Mixture of varieties	
	2n	4n	2n	4n	2n	4n
Protein	167	305	151	285	172	234
Non-protein	31	66	35	48	41	56
Total	198	371	186	334	213	290

diploids contains 43.3–56.4 mg total nitrogen including 35.2–45.9 mg protein and 7.0–10.9 mg non-protein nitrogen. The pollen of tetraploid plants contains 41.0–58.6 mg total nitrogen of which 33.7–50.0 mg is protein and 7.3–10.4 mg non-protein nitrogen.

Here, as in the case of the phosphorus compounds, no definite correlation appears between chromosome number and content of various forms of nitrogen in a one gram sample of pollen.

The direct relationship between the amount of chromosome sets and nitrogen content becomes observable when comparing nitrogen per one pollen grain. Thus, in the pollen grain of diploids there is 186–213 pg total nitrogen while in the tetraploids this increases to 290–371 pg.

About 5/6 of total nitrogen is protein-nitrogen. In the pollen grain of the diploids there is 151–172 pg while in the pollen grain of tetraploids 234–305 pg. The rest of the nitrogen is in the form of non-protein compounds. In the pollen of diploid plants 31–41 pg non-protein nitrogen is found, while in the pollen of tetraploids 49–66 pg.

The direct relationship between the degree of ploidy and the content of various forms of nitrogen in the pollen grain is readily observable in the pollen of the varieties Ramonskaya-023 and Verhnyachskaya-038. The data concerning the pollen mixture collected from plants of various varieties are less definite.

Discussion

The discussion of the changes of nucleic acid content in pollen grains in connection with the change of their ploidy deserves special interest.

A number of workers determining DNA content in the cells of some microorganisms and animals demonstrated that with increased complexity of the organism the amount of DNA in the cell increased while its content in the diploid cells of various tissues of the same organism remained the same. Haploid spermatozoids contain as a rule half the amount of DNA as compared with diploid cells, which is in good agreement with modern concepts on the role of DNA in heredity elaborated by molecular genetics (MITYUSHOVA 1964, SAGER et al. 1964, FAUTREZ et al. 1955).

Attempts were made also to determine the content of nucleic acids in the cells of plants (SAGER et al. 1964; Biochemists' Handbook, 1961); but in these cases results proved to be less definite. Authors often limit themselves to the count of nucleic acids in a special organ or in the weight unit of the plant tissue, which is not always sufficient. The difficulty of the determination of the nucleic acid content in the functional cell unit is largely explained by the absence of a sufficiently exact method facilitating the count of the number of plant cells in the sample taken for analysis. As a result some authors (MARÓTI 1960, 1961, 1963) did not reveal a positive correlation between the multiple increase of nuclear elements and the DNA content in the nucleus and are liable to think that the laws referred to above are characteristic only of microorganisms and animal cells but not of plants.

Some research workers (MAKAROV 1958) who agree that in the cells of developed organisms the DNA content per nucleus is more or less stabilized produce data bearing testimony on the inapplicability of the theory of the constancy of DNA in the sexual cells and in the early stages of embryogenesis. It is even stated that the nuclei of the ovules of some flowering plants (peas, clover) do not contain DNA at all.

The majority of the authors (RAVEN 1964) however, are of the opinion that the reduction of the intensity of the Feulgen reaction to such a degree that it cannot be established is the optical effect of the dilution of the colouring matter.

The final answer to the question proposed may be expected from the use of direct analytic methods.

MARÓTI (1960) determined the nucleic acid content in the sections of the little roots of diploid, triploid and tetraploid sugarbeet and did not find any relationship between the degree of ploidy and the amount of DNA and RNA per one section. This is in good agreement with our data. As a matter of fact, as already noted above, we could not detect any definite differences in the content of nucleolar and other forms of phosphorus in 1 g air dry pollen of diploids

and tetraploids. At the same time these differences are clearly visible in the comparison of the amounts of DNA phosphorus contained in one pollen grain. A doubling of the quantity of chromosomes causes a multiple increase (nearly 1 : 2) of the DNA phosphorus content.

This disagreement can be explained by the fact that the single samples contain different numbers of pollen grains of various degrees of ploidy. The pollen of tetraploid plants with a substantially higher weight, is found in the sample in a considerably lower amount, however disposes of an approximately identical amount of phosphorus and nitrogen compounds.

A direct proportional relationship is found also for the phosphorus of total RNA, of the mineral and organic part of the acid-soluble phosphorus, lipid phosphorus and the phosphorus of phosphoproteids. This applies also to the content in the pollen grain of protein-, non-protein and total nitrogen.

OGUR and co-workers (FISKE—SUBBOROW 1925) on yeasts also obtained values, multiple ploidy, not only as to amount of DNA but also of RNA, metaphosphates and cell weight which perfectly agrees with our data. WILLIAMSON — SCOPES (1961) separating the fractions of large and small yeast cells demonstrated that the RNA content was proportional to the volume of the cell while the amount of DNA did not depend on the dimensions of the cells. In the pollen, both as related to the RNA phosphorus and to DNA phosphorus, a similar picture is observed. However, we did not carry out fractioning of the pollen according to volume and therefore the differences between the samples reveal rather varietal differences.

From our data it follows that the average dimensions of the pollen grains of diploids fluctuate insignificantly and have no substantial influence on the total contents in the grain of phosphorus and nitrogen compounds. Among the tetraploids a positive correlation can be observed between the volume of the grain and its total phosphorus and nitrogen contents.

Above we repeatedly pointed to the increase, as compared with the diploids, of the variability of dimensions, weight and phosphorus and nitrogen compounds in the pollen of various tetraploid varieties. ROMMEL (1963) conducted a cytogenetical study of the autotetraploid varieties of sugarbeet and established that only 54—57 per cent of these carried in their cells exactly 36 chromosomes (euploids) while the others were aneuploids with a chromosome number of 32 to 38. The acute upset of the genetic balance caused by the deficiency or addition of one or several chromosomes generally leads to a change of the amounts and relations of the substances contained in the cell.

Conclusions

As a result of investigations it has been established that between diploids and tetraploids there are no definite differences concerning the amount of phosphorus and nitrogen compounds contained in the unit of weight of their pollen. However, the contents of these compounds in the functional unit — one pollen grain — changes in connection with the change of the degrees of ploidy quite definitely. The doubling of the chromosome set first of all leads to the doubling of the DNA content. A direct proportional relationship is also observed for total RNA, phosphoproteids, lipoids, acid soluble phosphorus compounds, proteins and non-protein nitrogen compounds.

The doubling of the nucleolar elements brings about the upset of the established relationships between nucleus and cytoplasm. In the process of its further life activity the nucleus causes a change of the quantitative side of the processes of metabolism.

This leads to the increase of dimensions and weight of the cell and also to the increase of the number of some cell structures (plastids, membranes, pores etc.). Thus polyploidy by changing the quantitative relationships in the cell of the most important chemical compounds determines the change of the phenotype of the plants and of their physiology.

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LIGHT-MICROSCOPIC STUDIES ON VOLATILE OIL EXCRETION IN *VALERIANA COLLINA* WALLR.

I. OBSERVATIONS REFERRING TO THE EXCRETION OF OIL-BODIES AND ON THEIR MORPHOLOGIC CHARACTERISTICS

By

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In the course of our work we have studied the problems of the formation, accumulation and metamorphosis of volatile oil in the young and older tissues of the vegetative organs of *Valeriana collina* Wallr., first of all in those of the root.

According to our investigations three kinds of oil-bodies get separated in the root. Of these the "calyptra oil-body" is a dissimilation product excreting in the course of the division of the meristematic cells, which is getting separated from the root together with the gradually decaying calyptra cells. The quantity of the "cortex" and "hypoderm oil-body" getting initiated in the stretching zone and the zone of root hairs respectively, changes in the course of vegetation, — thus one might conclude the reactivation of same.

Introduction

Concerning the volatile oil excretion in the root tissues of *Valeriana*, it was ZACHARIAS (1879) who first published detailed information on the oil to be found in the hypoderm of the root. VIDAL (1903) mentions already the oil to be excreted also under the hypoderm in the outer cortical cells the walls of which are not suberized. That problem was dealt with in a more positive form by FRIDVALSZKY (1957). Recently HOLZNER—LENDBRADL (1963) performed detailed and thorough light-microscopic examinations on the formation of the oil in *Valeriana* and on the basis of characteristics of the morphological formation of oil in the root, oil-vacuoles, oil-sacks and oil-containers were found in it. We are going to revert to these examinations on the forthcoming pages.

Material and Method

Our detailed examinations have been performed on individual plants of *Valeriana collina* Wallr. however, so as to make comparison, individuals of *Valeriana sambucifolia* Mik. and *Valeriana officinalis* L. have also been studied; essential differences in the volatile oil excretion of the species have not been experienced, therefore we do not mention these separately.

Plants to be examined have been raised under garden condition, while our observations on embryo-roots were performed on a material germinated in laboratory. Our investigations started on cuts taken from resting material then continued on germinating rootlets up to the opening of the cotyledons. The observation of the processes accomplished in roots of shoot origin and producing the drug itself, started from the root tip initiated in the rhisoma

tissues (SZENTPÉTERY 1965), — then went on in the formation (root tip), determination — (stretching) and differentiation (root hairs) zones of the primary root separated from the parental tissues then in developed primary root tissues and finally, in secondarily thickened root tissues. Our investigations were performed on the living tissues of plants gathered (from under the snow) in May, September and January.

Results and Discussion

Morphologic observations in connection with volatile oil formation and accumulation

The resting embryo contains in all its parts, thus in the rootlets, fatty oil and heterogeneous aleurone. In the course of the start of germinating these reserve nutrients are first mobilized in the rootlets then gradually at the upper levels they can — however — be proved, for the longest time, in the cotyledons. Immediately after the emerging of the rootlet the big refractive drops seen in the cells of the root tip, and being taken for volatile oil by HOLZNER—LENDBRADL (1963), are but fatty oil residues. According to our own observations, the volatile oil appears in the germ root only after the assimilation of the cotyledons has started. This observation of ours seems to support BONNER's (1949) statements according to which the biosynthesis of the terpenes starts only in the presence of green leaf or the extract of same. The volatile oil first appearing in the root tip of the germ root and excreting on the young transversal walls of calyptra and dermocalyptragen, will be called further "calyptra oil body". The germ roots often perish early but even if they get on developing, the oil types called "oil body of root cortex origin" and "hypodermis oil body" (see later) develop only to a lesser extent. Therefore, our detailed examinations were performed on the living tissues of roots of shoot origin.

In the roots of shoot origin calyptra oil body is separated as early as in the calyptra cells being divided in the root tip formed in rhizome tissues, while after the root tip has emerged from the parent tissue it appears within the calyptra, on the transversal walls of the anticlinally dividing dermocalyptragen cells. On the young cell wall, generally in the middle, small refractive bodies can be observed which, growing quickly, become globular or pear-shaped and after full development they often separate from the cell wall (Fig. 1). In the fully developed oil-bodies seen in the outer calyptra cells (Fig. 2), some chamber-like (honeycomb) structure can be concluded.

On this, however, reports have already been submitted by HOLZNER—LENDBRADL (1963) in connection with the hypodermis oil of *Valeriana*, while by BANCHER (1960) and ZIEGLER (1960), with reference to other plants.

HOLZNER—LENDBRADL (1963) qualifies the calyptra oil of *Valeriana* as oil-vacuolum and does not distinguish it sharply from the oil separating in the outer cortical cells of the stretching zone. According to our observations, however, the calyptra oil-body is a formation separated from the plasma and being

surrounded by a very elastic cover. On the basis of our observations made in several directions (SZENTPÉTERY et al., 1966), this cover is considered being of an origin of decayed plasma. In this connection we want to point out that

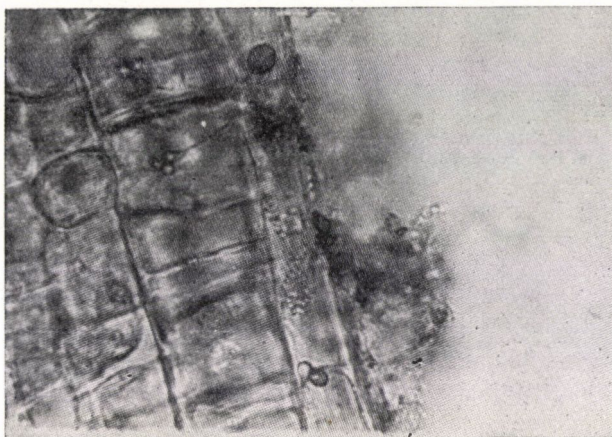


Fig. 1. Vertical section of the root tip of shoot origin with developing calyptra oil-bodies
× 240



Fig. 2. Vertical section of the root tip of shoot origin, with entirely developed calyptra oil-bodies in the outer calyptra row. × 240

LEHMANN (1925) qualified the membrane of the oil-holders as being of plasma origin, while KÜSTER (1956) described it as a cellulose kind degenerated plasma.

The "calyptra oil-body" is only a dividing calyptra, i.e. it develops in dermacalyptragen cells, — and in the stretching zone it cannot be observed at all. On the basis of our observations we concluded that the calyptra oil is a dissimilation product excreted in the course of the division of meristemic



Fig. 3. Vertical section showing the determination zone of the root of shoot origin. Initiating oil-body excreted on the radial wall. $\times 1000$



Fig. 4. Vertical section of the determination zone of shoot origin-root. The oil of root cortex origin being in the stage of string of beads $\times 1000$

cells, and is separated from the root together with the calyptra cells. We want also to mention that in the young calyptra cells also much starch can be observed besides the oil; this, as known from scientific literature, occurs in the calyptra of many a plant.

On the root tip, in the height where the side-layer of the calyptra is worn off, i.e. at the beginning of the determination zone, in the outer cell rows of the young cortex, there starts the excretion of an other volatile oil type, that of the so-called "oil-body of root cortex origin". On the transversal wall of the cells, generally in the medium line or thereabout, the cell wall is somewhat broadened and soon there excretes on it the so-called initial drop. In the cells both in the determination zone and higher, lively rotating tiny granules can

be observed. According to HOLZNER-LENDBRADL (1963), while cells are going to stretch, small refractive drops appear in the plasma and they approach, quickly moving on the transversal cell wall and when reaching this, they cause a swelling on it. In connection with the excretion of volatile oil, on the basis of literary data, the general opinion established itself that the oil gets first *separated* from the plasma, then it gets *excreted* from the cells into inter-cellular furrows, and in case of oil holding cells, into the sack (in the cell itself) surrounded by a covering layer (FREY-WISSLING 1945, LEHMANN 1925, LEE-



Fig. 5. Vertical section of the determination zone of the shoot origin-root. The oil-body of root cortex origin having a broadening head. $\times 240$

MAN 1928, MÜLLER 1905, SPERLICH 1939). According to our observations, however, in the case of *Valeriana* the numerous droplets rotating in the microscope, are no volatile oil separated from the plasma, — they are different cell-organella. Such rotating droplets are present everywhere in the living tissues, not only in the cells holding volatile oil. In addition to this, concerning the first oil secretions observed on the cell wall, a colour reaction specific of oil has already been obtained (SZENTPÉTERY et al., 1966) while the rotating droplets have never got coloured. Thus we have to suppose that in *Valeriana* the synthesizing of monoterpenes from the already existing precursors ensues only in the course of excretion.

Oil excretion occurring in the broadened medium line of the transversal cell wall is shown in Fig. 3. The oil drop being, at the beginning, of an irregular shape, shows soon the formation of a string of beads (Fig. 4). As proved by our observations, no dismembering into cupule and head occurs. In the course of further development the peaky part of the string of beads gets more and more broadened in the differentiation zone (Fig. 5), while the characteristic cupule and head of the volatile oil-body generally develops as early as the



Fig. 6. Vertical section of the root hairs zone in the root of shoot origin. Groups of oil-bodies of cortex origin. $\times 240$



Fig. 7. Vertical section of the root hairs zone in the root of shoot origin. Groups of oil-bodies of shoot origin being in different developmental stage. $\times 240$

beginning of the zone of root hairs. In that zone the oil-bodies with neck are located mostly in groups (Fig. 6) opposite one another on the radial wall dividing two neighbouring cells; however, in the same zone oil-bodies being in different stage of development, can also be observed (Fig. 7). In case of

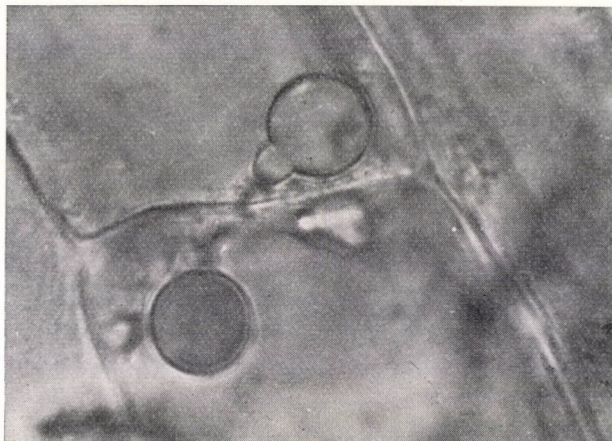


Fig. 8. Vertical section of the root hair zone in the root of shoot origin. Developed oil-body of root cortex origin. $\times 1000$

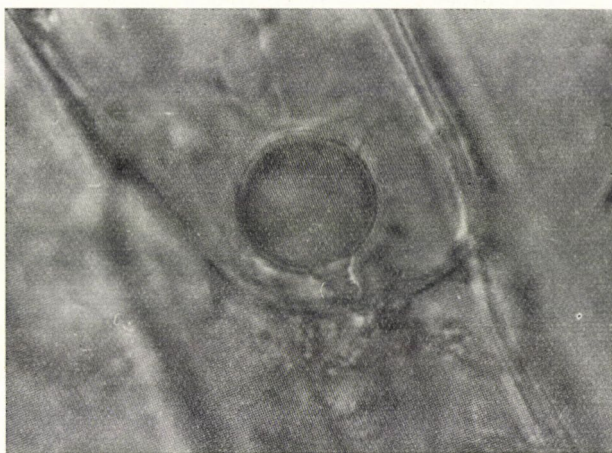


Fig. 9. Vertical section of the root hairs zone in the root of shoot origin. Developed oil-body of root cortex origin. $\times 1000$

light-microscopic examination it seemed to be rather difficult to decide whether in the developed oil-body there exists internal connection between the cupule and the head, since the cupule and the head are not located at the same level, and then, by lowering the tube of the microscope, different pictures are obtained (Figs. 8, 9). However, we managed to establish that the cupule and the head are

not separated by a dividing wall, their cover-layer is of similar construction and the oil might be located, depending on the state of development, both in the cupule and in the head.

The oil-bodies in the cortical tissues of the root primarily stabilized, are similar to those being found in the zone of root hairs, however, here no further oil-body formations have ever been noticed. In the course of secondary thickening of the root the head of the necked oil-bodies is gradually swelling at the expense of the neck and finally, in this state of development the cupulate of most oil-bodies entirely disappear (Fig. 10). Thus, in the older root the cupulate, too, becomes filled up and grows round. However, contrary to the calyptra oil-body, the oil of root cortex origin in the old root is never separated from the radial cell wall.

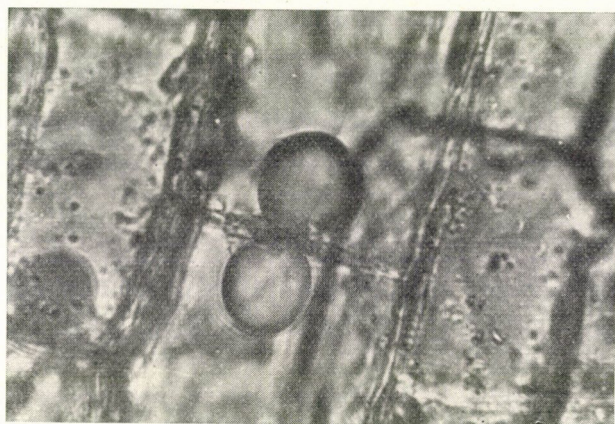


Fig. 10. Vertical section of the secondarily thickened root of shoot origin, with old root cortex oil. $\times 240$

Concerning the formation of the oil of root cortex origin, it was observed that while in the determination zone generally more ones are generally produced from each transversal wall, — from the zone of root hairs upwards, the number of oil-bodies originating from one wall, decreases gradually. In the primary stabilized root two-three oil-bodies are usually found in the cell-hole, while in the secondary root there is only one oil-body which, however, is considerably larger. The decreasing number of oil-bodies and, on the other hand, the increase of their size, seem to suggest their being merged together. Still, the course of this process could not be observed during our investigations.

The oil of root cortex origin always develops in living plasma containing cells, in the outer three or four cell rows of the subhypodermal cortical tissue. As mentioned previously, its excretion starts at the lower dividing line of the determination zone thus preceding the excretion of the reserve starch occurring

in the upper third of determination zone. Passing upwards along the root, increasing starch excretion can as well be experienced in the oil-holding cells. Subhypodermal cortical cells are living and plasmolizable even in the secondarily thickened root. Our examinations concerning plasmolysis, agree with those of HOLZNER-LENDBRADL (1963) therefore, we do not revert to it in particulars.

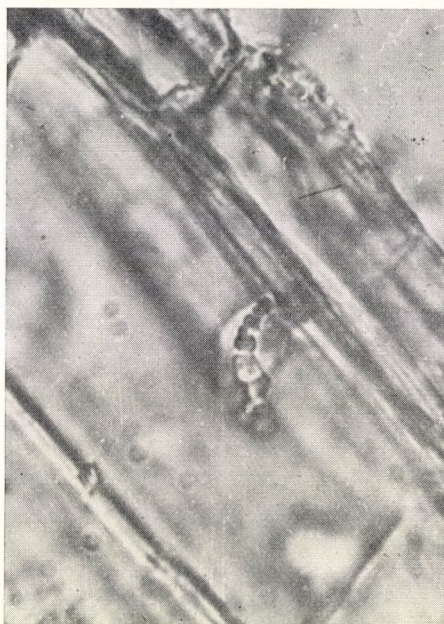


Fig. 11. Vertical section of the root hairs zone in the root of shoot origin. Hypodermis oil-body in the stage of string of beads $\times 240$

Passing over to the problem of the excretion of subdermatogenal, so-called hypoderm oil, similarly to results of HOLZNER-LENDBRADL, we have observed that the oil excretion starts in the hypodermis of the root, — as against the two other types of oil-body, — only at the beginning of the zone of root hairs. The observation of the excretion occurring in the hypoderm cells of *Valeriana* which cells are rather big ones, proved to be much more difficult either on the root tip or in the layers of the cortical cells under the hypoderm than had been expected. At the beginning of root hairs' zone, directly after the stabilization of the hypoderm cells, cell walls begin to become suberized starting from the outer tangential cell wall. After this, there appears — bound to the outer tangential wall — a volatile oil-body with one or two and sometimes three necks. At first the oil-body shows the stage of a string of beads (Fig. 11), then a cupulate and a big head is being formed on it (Fig. 12). When following the zone of root hairs in upward direction, we have experienced the string of beads-like cupulate to become gradually swollen

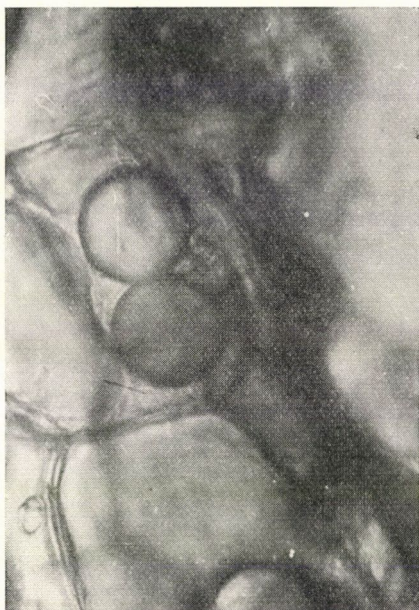


Fig. 12. Vertical section of the root hairs zone in the root of shoot origin. Hypodermis oil-body with cupulate and head. $\times 240$



Fig. 13. Vertical section of the root hairs zone in the root of shoot origin. Hypodermis oil-body with the cupulate filled and separated from the cell wall. $\times 240$

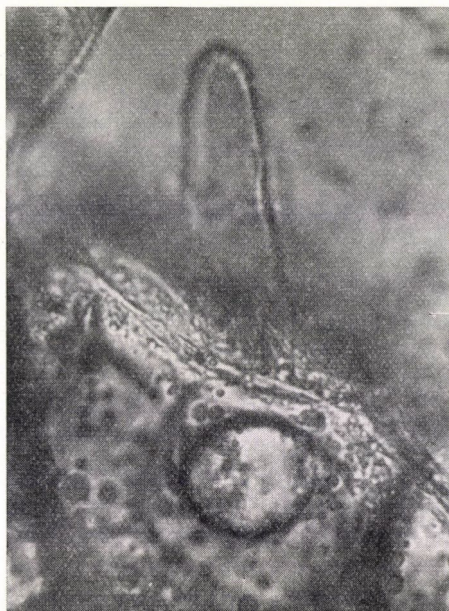


Fig. 14. Vertical section of the root hairs zone in the root of shoot origin. Necrosing plasma, hypodermis oil-body with a cupulate merged into the head. $\times 240$

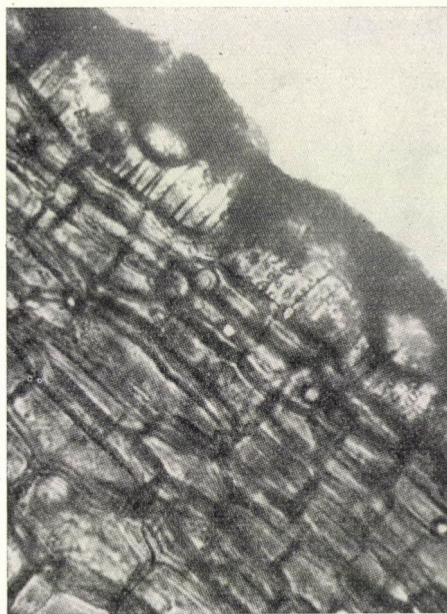


Fig. 15. Vertical section of the primarily developed root of shoot origin. Lath-like thickening in the hypoderm cells. Oil-bodies of root cortex origin in the subhypodermal outer cortical cells. $\times 100$

starting from the head towards the cell wall, then the oil-holder to be torn off the cell wall (Fig. 13), while the cupulate was gradually disappearing, i.e. becoming blended into the head. Parallel with the suberizing of the cell wall, its protoplasm is necrosing while refractive droplets not producing volatile oil fraction, appear around the oil-holder and are clinging to it (Fig. 14).

During the further development in the root, the suberization of the hypoderm cell wall gets more intensified and in the cells lath-like thickening develops (Fig. 15).



Fig. 16. Vertical section of injured root. Oil-bodies excreting on the tangential cell walls of the callus tissue. Oil-body excreting on the radial wall of the non-injured cortex tissue. $\times 100$

It is worth while mentioning that when root is injured oil excretion is always experienced, in the tissue formed on the spot of the scar, — should the injury have happened in any depth of the cortex, — however, it is not on the transversal wall as in case of the “oil of root cortex origin”, but similarly to the hypoderm oil-bodies, on the tangential wall (Fig. 16). Thus, the cell wall suberized before the oil excretion, has an influence on the type of the oil-body and on the spot of excretion.

From among the results of our investigations carried out in the course of the vegetation period, we want to point out that the number of the cortical — and hypoderm oil-bodies in the standardized tissues of the root are the highest in the rest period (gathered from under the snow). On the formation of the spring radical leaves and shoots above ground, the number of these oil-bodies

decreases. This examination agrees with the chemical examinations on oil content carried out in the course of vegetation, on the other hand, it thoroughly disagrees with the concept according to which the oil gets definitely excreted through metabolism (KISSER 1958). However, according to recent literary data the theory of the definite excretion of oils became rather doubtful (MORITZ 1962, PAECH 1950, VÁGUJFALVY 1964). Our observations made in the course of vegetation and referring to the formation of the oil-bodies conclude the oil reactivation.

On the other hand, as against the settled tissues, in the growing spring-roots the calyptra oil of the root tip is present in a much greater quantity than in winter when the root tips are in resting position. The arising and accumulation of the calyptra oil-body is supposed to be in connection with intense meristemic activity. Since according to our examinations, oil-bodies together with calyptra cells, are separated from the root tip, their role must undoubtedly be different from that of the cortex — and hypoderm oil accumulated for the rest period in the course of vegetation.

Besides roots we have performed investigations also with other vegetative organs of *Valeriana*. In the rhizome cortex excretion of, — as well as that of the hypoderm oil-body is similar to that of the root. In old rhizome in every cell of the broad suberized-walled periderm hypoderm-type oil-bodies, are being separated while in the parenchymatic and plasmacontaining cortex, up till the cortical border, even in the medullary ray, oil-bodies of root cortex origin can sometimes be observed.

Volatile oil is excreted in shoots above soil surface and in leaves first of all in glandular hairs and epiderm cells, less frequently in the outer cortical cells of the stem.

Conclusions

As proved by our examinations carried out in root tissues of different age 3 types of oil-body are excreted there in the course of the vegetation period of *Valeriana collina* Wallr. The oil-bodies are surrounded by elastic covers being of plasma origin; in the "calyptra oil-body", besides this, one may conclude to be existing also a chamber-like structure. Directly after the initial drop having excreted on the cell wall, the "cortical" and the "hypoderm oil-body" display a form similar to that of a string of beads, and are divided into cupulate and head. In older tissues the cupulate of the oil of root cortex origin becomes round while the cupulate of the hypoderm oil-body tears off the cell wall and will be merged into the head.

Calyptra oil-bodies, together with decayed calyptra cells are separated from the root, while the quantity of the "cortical" and "hypoderm oil-body" changes in the course of vegetation, — thus their reactivation might be supposed.

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INFLUENCE OF LIGHT ON CATALASE ACTIVITY OF LEAVES

By

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The action of the main source of energy in plant production the light on the catalase enzym activity is here dealt with. Catalase has been chosen because of its being one of the most widespread enzymes in living world and on account of its multiple intimate relationships it susceptibly responds to changes in plant metabolism. It is stated that catalase activity sensitively responds also to changes of light intensity. The possibility is raised that the quotient of catalase activity measured in light and in the dark of physiologically identical leaves may be suitable for the purpose of a diagnostic index.

Introduction

MICHNIEWITZ—STANISLAWSKI (1962) in their paper report the catalase activity of wheat seedlings kept in the dark to be higher as compared with that of seedlings raised on light. In the experiments of HASKINS (1955) enzym activity was higher in etiolated maize plants. According to the investigations of EYSTER (1950) the catalase activity of maize plants changes, beside other factors, also as a function of light intensity. In his opinion the enzym on light suffers photooxidation.

LAVOREL (1954, 1956) in his studies discusses the inhibitory effect of light on catalase activity. He exposes that at a light intensity inducing action, in 1—2 hours from the moment of illumination the constant catalase activity indicating the degree of inhibitory effect develops while in dark the initial higher activity of enzym is restituted approximately with the same velocity. The reversibility of the effect is in contradiction to the assumed photochemical destruction of catalase. According to the author the reduction of activity is the resultant of photoinactivation and spontaneous reactivation running parallel.

Materials and Method

Experiments were performed with the darkened leaves and/or leaves kept on light of various plants (*Prunus avium*, *Malus pumila*, *Pinus nigra*, *Phaseolus vulgaris*, *Zea mays*, *Syringa vulgaris*). Darkening was carried out in case of leaves left on the plant with aluminium foli cover, while isolated leaves were enclosed in a dark place. In case of primary foliage leaves of little *Phaseolus* plants raised in the glasshouse, for 1 hour supplementary illumination was

applied with a 500 Watt lamp. The lamp was placed at a distance of 1 m from the plant. To eliminate the heat effect a water layer was placed between lamp and plant in a glass container. In examinations on the spot with conifers from the basal, medial and apical parts of the pine-needle samples were taken separately on account of the gradient of catalase activity of the pine needle described elsewhere (FRENÝÓ—MIHÁLYFI, 1964).

To study the quotient of catalase activity measured in physiologically identical leaves kept on light and in the dark examinations were conducted with syringa leaves, continuously, in the vegetation period. Two members of the pairs of syringa leaves originating from the same nodus were considered as physiologically identical. Leaves were removed from the shoot and two members of the pair of leaves separately in the order of the leaf storeys placed in water with the petiole. One of the series was left on light in the laboratory, while the other shut up from light. After 20 hours in the members of the leaf pairs kept on light and in the dark we determined catalase activity and to obtain the quotient we subsequently divided the numerical values of the two oxygen volumes with each other.

Catalase enzym activity was determined with the gasometric method and instrument of FRENÝÓ (1962) in laboratory and partly outdoors, on the spot. Enzym activity is characterized with the volume expressed in cu.mm of oxygen released in 1 minute from 1 per cent hydrogen peroxide solution by the amount of enzym in the sample examined. In the case of 20 disk samples taken from leaves with a sampler activity was displayed by the wound surface of leaf disks, as a consequence of enzym activity manifesting itself there. The wound surface was identical in the variants compared.

Results

Table 1 illustrates the catalase activity of leaves darkened for 24 hours with foil and of non-darkened leaves from the same place, on the average of data. Examinations were performed on the spot (Table 1).

Table 1

Plant examined	m. mm O ₂ /min	
	Darkened leaf	Leaf kept on light
<i>Prunus avium</i>	65.2	43.7
<i>Malus</i> sp. "Starking"	59.4	50.8

Table 2

cu. mm O ₂ /min Zea mays				Note
Darkened		Control		
lower leaf	upper leaf	lower leaf	upper leaf	
80.0	—	—	28.5	Cloudy weather
—	78.9	21.4	—	
—	—	21.4	28.5	
—	—	21.4	28.5	
—	—	5.0	5.0	Intensive sunshine

A similar experiment was conducted with two-leaf maize seedlings raised in glasshouse. Period of darkening was 72 hours (Table 2).

The next experiment was carried out with primary foliage leaf pairs of *Phaseolus* seedlings. In this case beside the variants darkened and kept on light as a third variant leaves kept on light were given one hour supplementary illumination with a 500 Watt lamp. In control examinations enzym activity measured in the two members of pairs of leaves kept in the light was originally identical (Table 3).

Table 3

cu mm O ₂ /min <i>Phaseolus vulgaris</i>		
Darkened leaf	Leaf kept in light	1 h 500 W supplementary illumination
182.0	161.0	—
175.0	141.0	—
161.0	—	91.6
156.0	—	90.9

When examining catalase activity of the pine needle darkened and kept on light of *Pinus nigra* in five replications the following results were obtained (Table 4).

Table 4

cu mm O ₂ /min					
Pinus nigra darkened leaf			Pinus nigra leaf kept on light		
Basal	Medial	Apical part	Basal	Medial	Apical part
72.4	42.4	34.5	38.4	32.3	26.9
±	±	±	±	±	±
23.1	10.0	9.7	7.2	4.8	4.7

Table 4 illustrates the average of the data and the standard deviation calculated according to the formula

$$s = \pm \sqrt{\frac{\sum V^2}{n-1}}$$

From the above experimental results it appears that catalase activity of darkened leaves exceeded enzym activity measured on leaves kept in light. As it appears from experiments conducted with primary *Phaseolus foliage* leaves, under the influence of supplementary illumination the enzym activity continues to decrease. Data of experiments conducted with two-leaf maize seedlings indicate that influence exercised on one leaf does not affect the peroxide decomposing activity of the other one, and neither does its metabolism provided enzym activity is considered as a character of metabolism. Darkening

further intensified the gradient of catalase activity that could be demonstrated in the pine needles of *Pinus nigra*. It can be observed moreover that under the influence of darkening deviation between single individuals substantially increased.

In contrast to the above results, however, particularly in the case of ageing or starved leaves or those exposed to various damaging factors the catalase activity of darkened leaves was frequently lower than enzym activity measured on plants kept in the light.

Changes of different degrees of the catalase activity in leaves and leaf parts kept in the light and darkened attract the attention to the study of the quotient of catalase activity measured in leaves kept in the light and darkened respectively.

For this purpose examinations were conducted with *Syringa* leaves continuously in the vegetation period. In the order of the leaf storeys quotients were formed from the enzym activity measured in the member kept in the light and darkened of the leaf pairs. In Table 5 the numerical values of the quotients are included per leaf storey in acropetal order (Table 5).

Table 5

Data of examination	VI. 2	VII. 2	VIII. 8	IX. 2	IX. 11	IX. 27
Serial number of leaf storey downward from above	Light to dark quotient					
1	0.54	1.08	1.19	1.15	1.01	1.05
2	0.73	1.13	0.97	1.06	1.10	1.18
3	0.57	0.89	0.83	1.04	1.11	1.02
4	0.79	0.87	0.86	0.90	1.19	1.12
5	0.64	0.67	1.07	0.81	1.19	1.18
6	0.71	0.82	1.07	0.92	1.24	1.26
7	—	0.65	1.15	1.02	1.15	1.25
8	—	0.86	—	1.13	—	—
9	—	0.95	—	1.18	—	—
10	—	1.13	—	—	—	—
Average	0.63	0.90	1.04	1.02	1.14	1.15
	±	±	±	±	±	±
	0.09	0.17	0.13	0.12	0.07	0.09

It appears from this Table that in the youngest and highest leaves the numerical values of the quotients are higher while proceeding downwards in the mature leaves the quotient diminishes and rises again in the older leaves. Thus in the course of vegetation period with the ageing of leaves the numerical value of the quotient is on the increase.

It is a well known fact that within a shoot photosynthesis of the mature medial leaves is most intensive. This and the results of other examinations raise the possibility that photosynthesis or intensity of biochemical processes taking place in the plants could be perhaps characterized with the numerical value of the quotient. A lower or higher numerical value than certain limits could possibly indicate an unfavourable position while the quotient between the limits optimum course of metabolism.

The issue raised requires of course further thorough and wide investigation. If the above assumption proves to be correct the quotient of the catalase activities of physiologically identical leaves kept in the light and darkened might be suitable for the purpose of physiological indices of diagnostical character and further on the elaboration of a diagnostical process to be conducted on the terrain would not encounter special difficulties.

Conclusions

It is demonstrated that catalase enzym activity measured in plant leaves sensitively responds to the changes of light intensity. A comparison of catalase activity measured in illuminated and darkened leaves stresses the differences among individuals. The possibility appears that the quotient of catalase activities measured in light and dark of physiologically identical leaves might be suitable for the purposes of a physiological index of diagnostical character.

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EFFECT OF DATE OF SOWING ON THE YIELD OF KENAF (*HIBISCUS CANNABINUS* L.)

By

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Previous studies on the effect of different agronomic practices on kenaf (*Hibiscus cannabinus* L.) stressed the importance of date of sowing on the yield and quality of its fibers. The yield of the green stalks, the fiber yield, and the seed yield was successively decreased by delaying the date of sowing.

Introduction

Excluding cotton, crops grown for fiber production are few and occupy a limited area. Owing to the relative low yield of jute in Egypt and obstacles in the importation of its fiber and similar products, kenaf was looked to be a good substitute of jute that suited the Egyptian local conditions.

The date of sowing strongly affects the yield of kenaf. CRANE et al. (1946) in Cuba found that, for fiber production, it was preferable to start planting as early as possible during April and May if there is adequate rainfall at that time. However, for seed production ORESTE (1937), CRANE—ACUNA (1945) and CRANE et al. (1946) in Cuba stated that planting should be done in July or August.

GANSTAD et al. (1951) in Florida found that the best yield of fiber was produced from sowings from April through June and later plantings produce less yield with unfavourable fibers. For seed production the investigators stated that July was the best, and later plantings were generally too short to produce satisfactory amounts of seed.

In Los Banos, GUANCO (1953) found that May was the best time for planting to obtain highest fiber yield. DE LA CRUZ (1954) obtained the highest yield of fibers and seeds in March, April and May sowings.

In South Africa, many investigators, KOCH (1948), KOLBÉ (1952), and OSSEWAARDE (1952) ascertained that the highest yield with long valuable fiber was produced from October to December sowings.

EL-KILANY (1931) and NAZIF (1958) in Egypt studied the effect of date of sowing on the yield of kenaf. They concluded that May and June plantings gave the highest yield of both fibers and seeds.

The present study was, therefore, undertaken as an attempt to investigate the influence of date of sowing on the growth and yield of kenaf.

Materials and Methods

Two experiments were carried out at the farm of the High Institute of Agriculture at Zagazig, U.A.R. during the seasons of 1959 and 1960. In the season 1959 5 dates of sowing were used. These were: March 12, April 1, April 21, May 11 and May 31, however, in the season 1960 the last date was excluded. The clay loamy soil had previously been planted to Berseem (*Trifolium alexandrinum*) then plowed twice with a tractor and levelled twice. No farmyard manure was used before plowing. Plowing, levelling and ridging were done at the right time. The amount of seed used per plot was 42 grams of kenaf variety (Giza 3). This is a rate of seeding 10 kgs/acre. The seeds were treated before sowing with Orthocide 75 at manufacturer rate in order to insure even stand and to avoid replanting. Plants in each experiment were irrigated every 10 days during their life period. Hoeing was carried out 3 times from the time of germination until the plants were 50 days old.

The plants of every date of sowing in both 1959 and 1960 seasons were harvested when the colour of the lower capsules changed from green to yellow and those lower capsules became dry. At the time of harvesting the plants were 203, 192, 182, 174 and 154 days old for March 12, April 1st, April 21, May 11 and May 31 plantings. The plants were cut with a hoe near the soil surface and then tied in small bundles and weighed immediately. The capsule bearing ends of the stems were cut three days from harvest. These upper parts were left to dry. The bundles of the stalks then were set in a small canal in the farm, filled with stagnant water which was flooded every three days until retting was completed. Then the retted stalks were thoroughly cleaned and the retted fibers were stripped by hand, re-washed with clean water and left to dry in the sun, then weighed. The dry capsule bearing stem ends were beaten with a stick to thresh the seeds. The weight of the clean seeds was then recorded.

Results

Flowering of plants

Table 1 shows the differentiation in the time of flowering at each date of sowing in the two seasons of experimentation. In 1959 season, plants of March 12 flowered for the first time on August 13 when they were 154 days old and they were in full bloom on August 25 when they were 166 days old. On these plants false sterile flowers appeared on May 25 when they were 74 days old. The plants of April 1 flowered for the first time on August 15 when they were 136 days old. These plants were in full bloom on August 29 and they were 150 days old. False sterile flowers appeared on these plants on June 2 when they were 62 days old. The plants of April 21 flowered for the first time on August 20 when they were 121 days old and were in full bloom on September 2 when they were 134 days old. Plants of May 11 flowered for the first time on September 1 when they were 113 days old and these plants were in full bloom on September 15, and were 127 days old. Plants of May 31 flowered for the first time on September 1 in the same time with the plants of May 11, having an age of 93 days. They were in full bloom on September 17 when they were 109 days old. No false sterile flowers appeared on the last three dates of sowing.

In 1960 season the plants of March 12 flowered for the first time on August 11 when they were 152 days old and were in full bloom on August 24 when they were 165 days old. False sterile flowers appeared on May 14 when the plants were 63 days old. Plants of April 1 flowered for the first time on August 15 when they were 136 days old and they were in full bloom on August

27 when they were 148 days old. False sterile flowers appeared on these plants on May 19 when they were 48 days old. Plants of April 21 flowered for the first time on August 19 and were in full bloom on September 4 when they were 120 and 136 days old respectively. Plants of May 11 flowered for the first time on September 3 when they were 115 days old and they were in full bloom on September 15 when they were 127 days old. No false sterile flowers appeared on either the plants of April 21 or the plants of May 11.

The green yield per acre

Table 2 shows the mean yield of green stalks as affected by date of sowing. In general, the mean green yield of kenaf plants dropped successively towards the late sowings.

In 1959 experiment, the mean yield of March 12 was 37 785.60 kg per acre whereas the yield of May 31 was 17 776.80 kg per acre. The second date of sowing on April 1st gave a mean green yield of 36 619.20 kg per acre. Sowing on April 21 gave a mean yield of 33 530.40 kg per acre, and sowing on May 11 gave the mean yield of 24 890.40 kg per acre.

In 1960 experiment planting on April 1st gave the highest mean yield of 30 045.60 kg per acre, whereas planting on May 11 gave the lowest mean yield of 18 398.40 kg per acre. The first date of sowing on March 12 gave 26.774.40 kg per acre and April 21 sowing gave 22 339.20 kg per acre.

Statistical differences showed that the yield per acre in 1959 experiment could be arranged in four groups. The first contained the two early dates of

Table 1

Staggering of the time of flowering during two seasons of experimentation

Date of planting	Date of opening the 1st flower	Appearance of the first flower after planting	Date of false flowering
1959			
March 12	August 13	154 days	May 25
April 1	August 15	136 „	June 2
April 21	August 20	121 „	—
May 11	Sept. 1	113 „	—
May 31	Sept. 1	93 „	—
1960			
March 12	August 11	152 days	May 14
April 1	August 15	136 „	May 19
April 21	August 19	120 „	—
May 11	Sept. 3	115 „	—

Table 2

Mean green weight in kg as influenced by date of sowing in both 1959 and 1960 seasons

Date of sowing	Green weight in kg per acre	
	1959	1960
March 12	37,785.60	26,774.40
April 1	36,619.20	30,045.60
April 21	33,530.40	22,339.20
May 11	24,890.40	18,398.40
May 31	17,776.80	—
L. S. D. 5% level	2 659.20	2,503.2

March 12 and April 1st which gave 37 785.60 and 36 619.20 kg per acre respectively. The second was April 21 sowing which yielded 33 530.40 kg per acre. The third was May 11 which yielded 24 890.40 kg per acre, and the fourth group was May 31 which yielded the lowest mean yield of 17 776.80 kg per acre.

In 1960 experiment the green yield per acre was relatively lower than 1959 experiment.

Statistical analysis showed that the yield of April 1st was highly more significant than that of all the other dates of sowing. Both the earliest and the latest sowings gave lower yields than the intermediate dates.

The fiber yield per acre

Table 3 shows that the mean fiber yield per acre tended to decrease by later plantings.

In 1959 season the lowest mean yield of 1032.00 kg per acre was obtained from the May 31 planting. The highest mean yield of 2332.80 kg per acre was obtained from the April 1 planting. Sowing on March 12 gave 2330.40 kg per acre. There was no significant difference between the previous two dates of sowing. Planting on April 21 and May 11 gave 2035.20 and 1584.00 kg of dry fiber per acre respectively. There was no significant difference between the first two dates of sowing March 12 and April 1. (However, these two dates differed significantly from the other three dates, April 21, May 11 and May 31 respectively.)

In 1960 season sowing on April 1st gave the highest mean yield of 2328.00 kg of dry fibers per acre whereas sowing on May 11 gave the lowest mean yield of 1238.40 kg per acre. Sowing on March 12 gave 1692.00 kg per acre and sowing on April 21 gave 1903.20 kg per acre. Sowing on April 1 outyielded the other three dates of sowing significantly.

Table 3

Mean fiber yield in kgs. per acre as influenced by date of sowing in the seasons 1959 and 1960

Date of sowing	Fiber yield in kgs. per acre	
	1959	1960
March 12	2330.40	1692.00
April 1	2332.80	2328.00
April 21	2035.20	1903.20
May 11	1584.00	1238.40
May 31	1032.00	—
L. S. D. 5% level	269.16	351.50

The seed yield per acre

Generally the mean yield of seed dropped towards the late sowings (Table 4). In 1959 experiment, the mean yield of March 12 was 458.40 kg per acre, while May 31 sowing yielded 364.80 kgs. per acre. April 1, 21 and May 11 gave 453.60, 386.40 and 321.60 kg of seeds respectively. There was no significant difference between the first two dates of sowing March 12 and April 1, though there was a significant difference between these two dates and the other three dates of sowing.

In 1960 experiment the yield per acre was relatively lower than 1959 experiment.

However, the highest yield was obtained from March 12 sowing and the lowest yield from May 11. The mean yield per acre was 415.20, 374.40, 372.00 and 321.00 kg for March 12, April 1, April 21 and May 11 respectively. The difference between the first date of sowing and the other three dates was significant.

Table 4

Mean seed yield in kg per acre as influenced by date of sowing in both 1959 and 1960 seasons

Date of sowing	Mean seed yield in kg per acre	
	1959	1960
March 12	458.40	495.20
April 1	453.60	374.40
April 21	386.40	372.00
May 11	321.60	331.20
May 31	364.80	—
L. S. D. 5% level	43.20	40.80

Discussion and Conclusion

Flowering of kenaf plants

The data presented in Table 1 indicates clearly that through two successive years of experimentation in Egypt, kenaf plants of the variety Giza 3 whether planted as early as mid March or as late as the end of May started to flower at almost the same time.

Although the difference between the early and late plantings were almost 2.5 months in 1959, and 2 months in 1960, the beginning of flowering was delayed only 18 and 23 days respectively.

It might be suggested in this respect that initiation of flowering in kenaf is affected by the day length much more than by the date of sowing. This result is similar to those obtained by CRANE et al. (1946) who found that the kenaf plant would not flower in Cuba until the length of the daily illumination was shortened to approximately 12.5 hours or less regardless of the date of sowing.

Kenaf plant characters

Early sowing on March 12 and April 1 outyielded the later dates of sowing in both green weight and yield of fibers.

The increase in green weight of early sown kenaf over that planted late in the end of May 31 amounted to almost 20 tons per acre. This extra amount of green weight resulted in an increase of 1.25 tons of dry fibers per acre.

This means that late sowings resulted in a loss of 53% in the green weight of the plants and 56% in the weight of dry fibers.

In 1960 there was a drop in yield of March 12 planting. Yet, April 1 sowing gave the highest yield. Heavy rains damaged the stand of March 12 in the early treatment and no resowing could be done to ensure accurate results under normal conditions. Thus April 1 sowing exceeded all other treatments in both green and fiber yields. The reduction in yield of the late sowing of May 11 reached 39% in the green yield and 47% in the fiber yield.

It was obvious that plants under early sowings produced the highest green and dry fiber yields. That might be due to the gain in both plant height and stem diameter owing to the extra length of the vegetative growth period which preceded flowering. For example in 1959 March 12 and April 1st plants were about 400 cm tall whereas May 31st plants reached a height of about 334 cm. In 1960 the plants of April 1st were 375 cm tall whereas plants of May 11 were only 370 cm. The stem diameter was 18.0 mm and 14.7 mm for these two dates respectively.

It is also clear from the data in Table 4 that the seed yield was higher under early sowings. This might be due to the fact that plants sown early

in the spring had better chances to achieve more vigorous growth before flowering. This encourages flowers and capsules to set much more since the amounts of early formed and reserved food should be ample.

Plants sown later in the season gave low yields of seeds due to the fact that the plants had a shorter period to produce satisfactory vegetative growth before they start setting seeds. Seed production requires a satisfactory vegetative growth and branching prior to the beginning of flowering; this is accomplished by planting as early as possible in the season.

It may be concluded that in U.A.R. the month of March and early April proved to be the best sowing time for kenaf.

This is nearly similar to the aforementioned results by GUANCO (1953) and DE LA CRUZ (1954) in Los Banos.

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EXAMINATION OF SECRETORY CAVITIES AND THEIR EXCRETION IN THE PERICARP OF THE CORNEL (*CORNUS MAS* L.)

By

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In the course of histogenetical investigations conducted in connection with the development of inflorescence and flower (JUHÁSZ 1964) in the inner lignified layer of the fruit of *Cornus mas* (in the pericarp of carpellary origin) mostly isodiametrical secretory cavities developing lysigenically have been demonstrated. In these by the time of maturation lemon or orange yellow, possibly wine-red solid and hyaline shining fillings appear in these and are, in contrast to the so-called true resins readily soluble in water and aethanol; from their solution gallic acid free and in ester bond, digallic acid in traces and chlorogenic acid have been identified so far.

Introduction

The species involved *Cornus mas* is a shrub reaching a height of 2—5 m. It is found both in mixed forests and shrubberies, a Central European species of Mediterranean character (Soó—JÁVORKA 1951). It is easy to recognize because it is flowering before foliation in March and its bright-yellow tiny flowers lend an agreeable dash of colour to the early spring forest. When flowering is completed, from the inferior pistil of the flowers a fleshy drupe develops — Fig. 1 — (Soó 1963) which rather protractedly — also depending on exposition — ripens by August—September. It is of red colour, elongated oval or cylindrical, 1—1.5 cm long. On the basis of its diversified types several forms of the species could be separated (PRISZTER 1962).

The external fleshy substance of this fruit is savoury, aromatic and thus in some regions utilized for preparing jam, syrup and fruit wine (HEGI 1926; Soó—JÁVORKA 1951) while the internal sclereid cell layer (*putamen*) containing 1, 3, 4, 5 seeds was sometimes utilized as coffee substitute (GRIEBEL 1917). Its seeds of rich fatty oil content were used in food supply and soap making (HEGI 1926).

While for the systematic, ecological and morphological conditions of *Cornus mas* we can rely on many sources (HARMS 1898; WANGERIN 1910; HEGI 1926; Soó—JÁVORKA 1951; PRISZTER 1962; KRÜSSMANN 1960; DEBRECZY-RIBLY 1962; Soó 1963; SÁRKÁNY—SZALAI 1964, etc.) in the general histological sense lesser available material is found (SERTORIUS 1893, SOLEREDER 1899, HORNE 1914; GREGUSS 1945; METCALFE—CHALK 1950, JUHÁSZ 1964)

and almost nothing for the histology of flower and fruit and/or their developmental conditions. Among works we may refer to the study of GRIEBEL (1917) who examined the fleshy substance of the pericarp and to the work of WILKINSON (1944) entitled "Floral anatomy of some species of *Cornus*". In this latter though stress is laid on flower organization, more particularly to the question of the inferior ovary, also anatomical description of the flower of some species, i.e. that of *Cornus mas* is dealt with.

Phytochemical investigations conducted within the family *Cornaceae* have led up to the present to several interesting statements; with these, how-



Fig. 1. Shoot portion with fruit of *Cornus mas*

ever, for the most part only the material of knowledge concerning foliar leaves and flowers increased. The study of BATE—SMITH (1962) on leaf phenols should be particularly stressed in which ellagic acid, quercetin and k  mpherol were demonstrated in *Cornus mas*, while HEGNAUER (1964) in his important chemotaxonomical work refers to the fact that from the flowers of the species in question rutin and gallic acid could be identified. He also draws the attention to the fact that in foliar leaves and cortex aluminium accumulation attains a remarkably high value. SWAIN (1962) refers explicitly for the fruit of *Cornus* to the presence of ellagic acid and flavonols. Also the statement of DELAVEAU—PARIS (1961) should be mentioned who demonstrated verbenalin from flower, leaves and cortex.

As appears from what has been said above, in connection with flowers and fruit developing then ripe of *Cornus mas* we dispose only of scanty data and thus the initiative is justified that the systematical and detailed histological, histo- and phytochemical study of *Cornus mas* should obtain a special weight.

Material and Method

Material of investigation was collected in 1963—64 from the cornel stand of the Botanical Garden of the L. Eötvös University and from the Buda mountains, more exactly from Farkas-völgy in Buda, in a stand of southern exposition of a mixed forest, weekly and/or in 10 day intervals. In 1965 supplementary sampling was carried out during the whole vegetation period and in the winter period of dormancy. Thus for investigations inflorescence of bud-state or flower primordia, developed inflorescence and flower and subsequently fruit of various developmental stage and ripe fruit were available.

Part of the material collected was fixed in Bouin and after embedding in paraffin microtome serial sections were produced. Staining of the preparations was carried out in Ehrlich's haematoxylin (SÁRKÁNY—SZALAI 1964).

Another portion of the samples was elaborated in living condition, the evolutionary-morphological stages having been fixed with stereomicroscope of the Cytoplast type. On manual sections we endeavoured to demonstrate with histochemical reactions various metabolic products and their localization, progress of the lignification of the putamen of the fruit etc.

For chemical investigation a plant material in various developmental stages was dried at 60 °C, from the ripe fruit also stereomicroscopic preparation was carried out in order to identify the solid excretion material demonstrated in these examinations.

Our phytochemical work was mostly directed to establish the physico-chemical constants of the excretion referred to and to the identification of its components. In these activities we employed a micro Op.-determining equipment system Kofler (KOFLER 1954) and thin-layer chromatographic method respectively (STAHL 1962).

Results and Discussion

Inflorescence or flower organization of *Cornus mas* sets on very early, end of May. By the end of June or early in July the individual parts of the flowers, the perianth-, stamen- and gynoecium primordia can already be demonstrated. In August the flowers enclosed in the inflorescence bud are further differentiating and become well delimited; these unfold after the dormancy period of winter and after further growth in the spring of next year.

Examining histologically the primordia of the gynoecium of a bud in this developmental stage the future 2 seed cavities become visible in the medial plain of the pistil; the tissue layer around it, however, is still homogeneous and built up of cells with large nuclei (Fig. 2). Not much later but still prior to defoliation in the cells beside the 2 enlarged seed cavities filled out with ovules differentiation occurs. This begins with some enlargements of individual pairs of cells while their nuclei withdraw to the cell wall (Fig. 3). Nucleus and wall become subsequently thinner (Fig. 4) and lysis ensues which is spreading gradually to the adjacent cells (Fig. 5). Thus lysigenically somewhat elongated or isodia — metrical secretory cavities develop (Figs. 6, 7), not of the duct or duct system type but in the form of separate cavities (Fig. 8).

During flowering and subsequently the secretory cavities referred to still increase by the merger of further cells (Figs. 9, 10, 11) and even new lysigenic initiation is experienced. In the surrounding cells greatly flattened and pitted (Fig. 12) an intensive lignification sets on in about 3 months from flowering which can be demonstrated first of all in the vicinity of the seed cavity and proceeds in the direction of the surface. In the fruit developing first green then

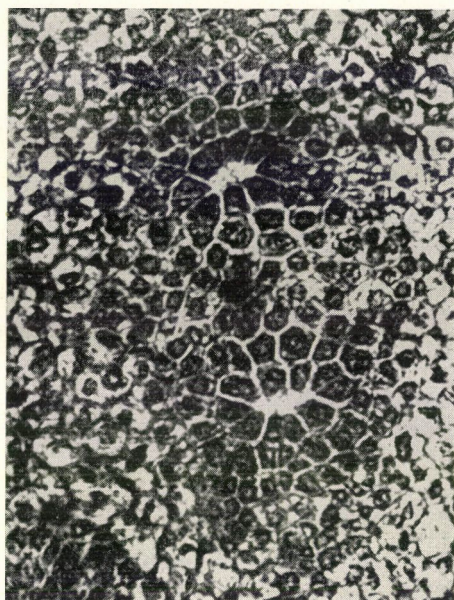


Fig. 2. Gynoecium primordia with the two seed cavities, in cross section ($6.3\times$ MF projective oc., $20\times$ achromat obj.)

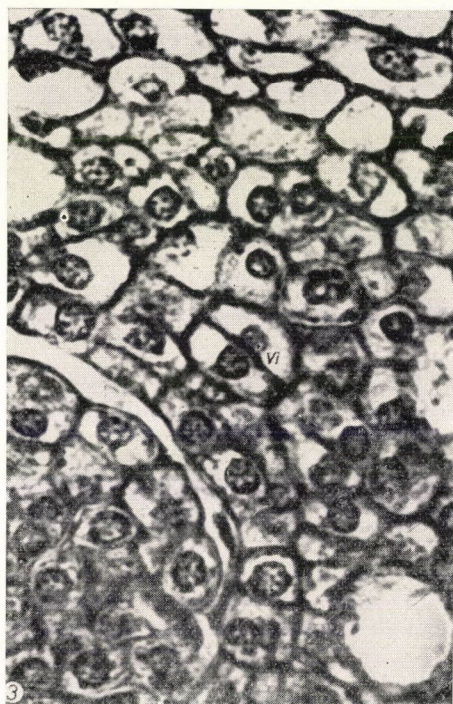


Fig. 3. Beginning of the initiation of the excretion cavity, in cross section
Vi = Initial pair of cells of the excretion cavity ($6.3\times$ MF projective oc., $40\times$ achromat obj.)

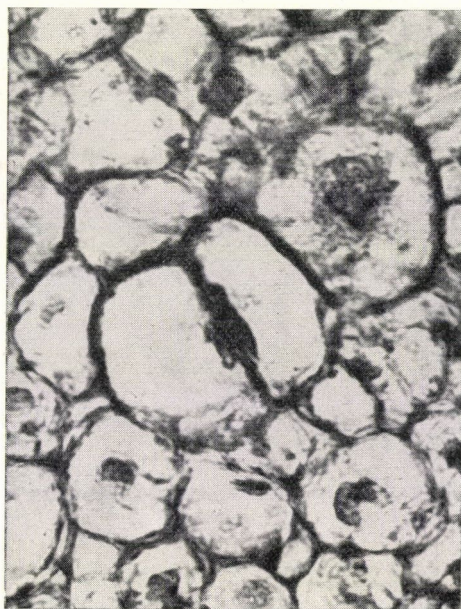


Fig. 4. Later stage of the initiation of the secretory cavity in cross section.
($6.3\times$ MF projective oc., $40\times$ achromat obj.)

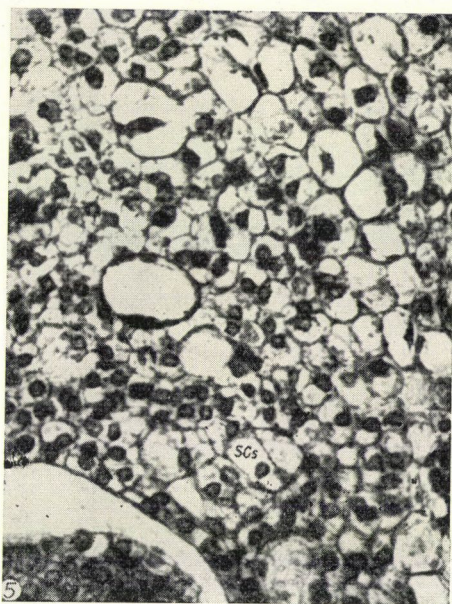


Fig. 5. Participation of cell groups in the formation of secretory cavities, in cross section.
SCs = cell group ($6.3\times$ MF projective oc., $40\times$ achromat obj.)

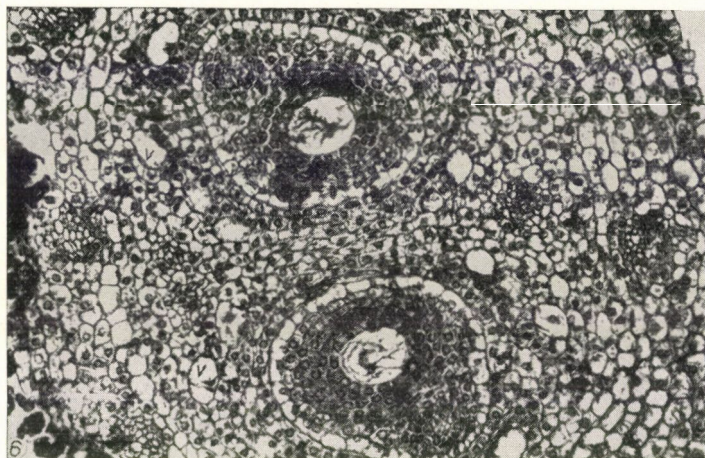


Fig. 6. Cross section of bud with secretory cavities, developed around the 2 seed cavities
V = secretory cavities (4× MF projective oc., 8× achromat obj.)



Fig. 7. Longitudinal section of bud with secretory cavities developed around Mv 2 seed
cavities
(4× MF projective oc., 8× achromat obj.)

discolouring the thickening coupled with lignification is deepening into canals (Fig. 13) which results in the formation of the drupe. Meantimes the excretion substance of the large cavities is solidified and can be prepared from ripe fruit (Figs. 14, 15).

The solid and hyaline shining, lighter or darker yellow, possibly wine-red excretions are varying as to their shape, generally reflecting the form of the secretory cavities: they are rounded off or funnel shaped, having no definite melting point; their softening point at which they suffer a change of shape and

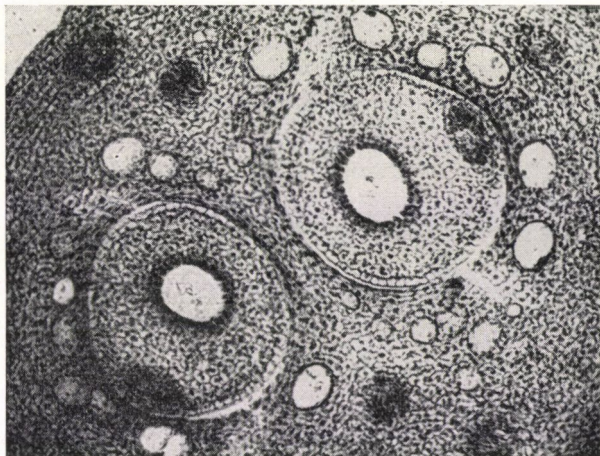


Fig. 8. Older bud-cross section with continually growing secretory cavities
(4× MF projective oc., 8× achromat obj.)



Fig. 9. Secretory cavities during the process of lysis, longitudinal section
(6.3× MF projective oc., 4× achromat obj.)

colour is at 270—275 °C. When raising the temperature they are vaulting like sugar and carbonizing. Their specific weight is somewhat below 1. As to their solubility — in contrast to the true resins (TSCHIRCH 1906, HALMAI 1963) — they dissolve to 95—96 per cent both in water and aethanol. The remaining 4—5 per cent is emulsion like; it can be considered as rubber or resin product. — Their aqueous solution is of mildly acid reaction; pH is 5.5—6. In such solution, on the effect of reagent ferrichloride a violet-blackish colouration or precipitation arises at once. — At the softening point referred to also micro-

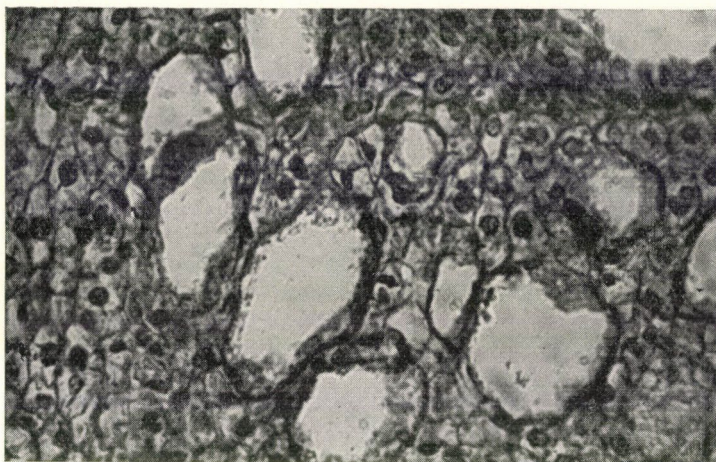


Fig. 10. Participation of several adjacent cells in the process of lysis; longitudinal section ($6.3\times$ MF projective oc., $20\times$ achromat obj.)

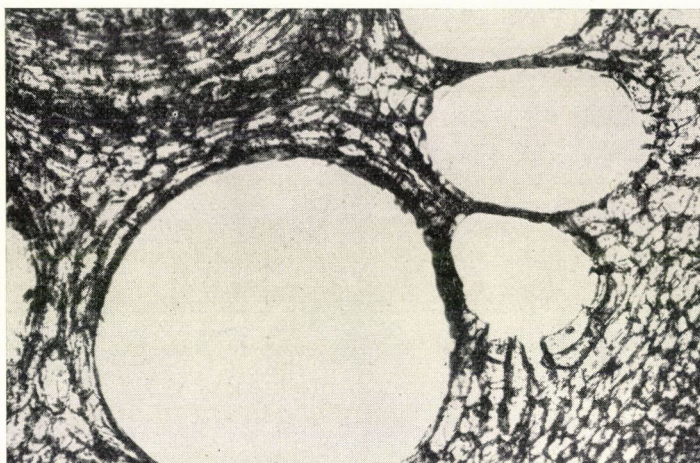


Fig. 11. Cross section of half ripe fruit with secretory cavities of great lumen ($6.3\times$ MF projective oc., $8\times$ achromat obj.)

sublimate can be obtained. Tiny and longer needle-crystals segregate the micro-melting point of which has been found to be about $230-240^{\circ}\text{C}$.

In the following we initiated chemical identification of the purely separated resin-like substance and of the microsublimate; first of all we examined for phenol-type compounds and their derivatives. Here several treatments were applied. The first portion of excretion had been solved in methanol (I), another identical quantity in water and hydrolysed — acidified with reagent hydrochloric acid — for $1/2$ hour. After distilling the hydrolysate on water



Fig. 12. Cross section of portion of pericarp. With pitted cells of wall thickness
($6.3\times$ MF projective oc., $20\times$ achromat obj.)

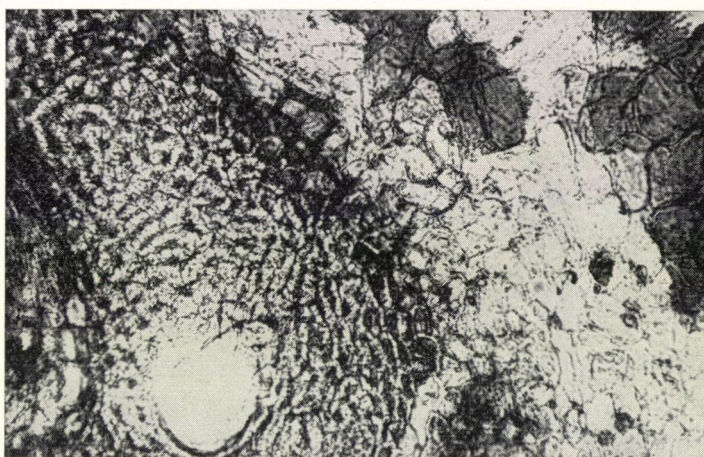


Fig. 13. Cross section of fruit. With cell groups of tannic acid content and sclereid substance
($6.3\times$ MF projective oc., $8\times$ achromat obj.)

bath the rest was dissolved also in methanol (II). As a third sample the microsublimate came again into methanol solution (III).

To determine the spectrum of the samples produced the thin-layer chromatographic method was applied. Layers were produced with the 3 : 7 ratio suspension with water of Kieselgel-G (Merck) and then activated for 1 hour at 110°C in an exsiccator. The application of the material was carried out at a distance of 1.5 cm from the lower edge of the plates so that for the single samples referred to 100 microgram came on the plates.

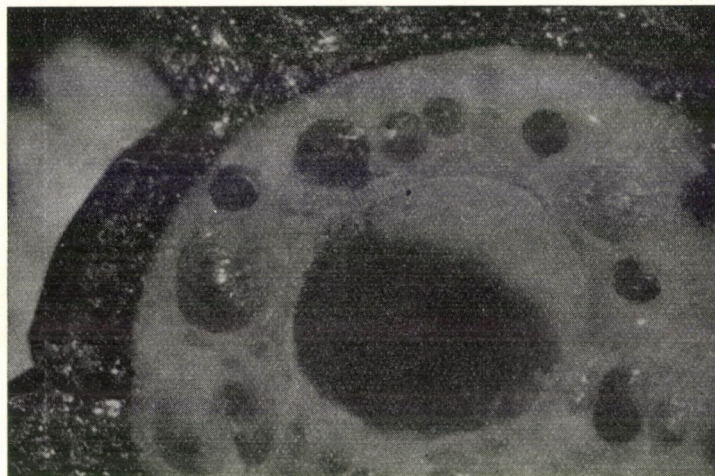


Fig. 14. Cross section of ripe fruit with secretory cavities. 25×



Fig. 15. Prepared excretions. 16×

Among several running systems suggested for the separation of groups of compounds of the phenol type the method of STAHL (1961) proved to be most suitable. According to this method most perfectly delimited spots were obtained with a 50 : 40 : 10 ratio mixture of chloroform—acetylacetate—formic acid. After running to 12 cm front height the plates were dried up and reacted with a 5 per cent solution of phosphorus—molybdic acid prepared with methanol. Phenol derivatives appeared as greyish-black spots while the basis was left light-grey. In ammonia steam space on the other hand the basic colour of the plates turned into white again while that of the spots deepened until blackening.

On Fig. 16 a chromatogram produced with the above method is seen. From this it appears that in the excretion material examined both in free condition (I) and in ester bond (II) — particularly in the latter — gallic acid



Fig. 16. Layer chromatogram of various phenol derivatives and of the test samples (I, II, III) 1. Catechine, 2. Floroglucine, 3. Pyrogallol, 4. Gallic acid (grated), digallic acid (pointed), 5. Benzoic acid, 6. Cinnamic acid, 7. Chlorogenic acid (lined), 8. Ferulic acid, 9. Coffeic acid

can be identified to a significant extent and even the spot of the needle crystals of the microsublimate (III) falls in the direction of gallic acid. Besides a spot was obtained also in the chromatogram of sample I at the place characteristic of digallic acid while in the samples I and II positive reaction was observed also on chlorogenic acid.

Conclusions

Comparing the above results with the data of literature discussed it can be established that our investigation series related to the histogenesis of the secretory cavities developed in the pericarp and our initiative to identify the solid excretion prepared out of these cavities have led to new informations concerning the species in question. — These statements may perhaps deserve attention in the light that these lysigenic secretory cavities and their content substances — in our opinion — do not come into being as a result of a pathological process as found in numerous woody plants particularly those supplying rubber-resins (KISSER 1958, HALMAI 1963) but they develop parallel with the organization of the pericarp and their role may presumably be connected with germination.

We intend to continue our work in order to disclose the relationship between the lysis of cells and the chemical composition of excretion continu-

ously restored as well as to record changes arising during germination. For this purpose it seems very important to discover various fine structure examination methods and to extend the work in this direction.

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CONTRIBUTIONS TO THE GREEN MANURING OF RICE

By

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During three years (1958-1960) investigations were conducted on a lime-deficient alkali (Szik) soil concerning green manuring of rice with mixtures of hairy vetch and rye or barley respectively for various rice varieties.

According to experimental results green manuring has caused an increase of rice yields by 16 per cent. Still, the method under Hungarian conditions cannot be recommended for universal introduction because it does not seem economic. It is a better solution to utilize green mass for feeding because the rice crop increasing effect of the stubble and root rests of the green manure plant is also as high as 11 per cent and besides, the farm obtains valuable green fodder.

Introduction

Rice growing soils of Hungary are generally poor in organic matter. In most places stock keeping is insufficient and the small amount of farmyard manure is given preferably to row crops. Although with the introduction of crop rotation the productivity of soil will improve, higher yields will be only obtained with better organic matter and nitrogen supply of the rice fields.

To satisfy the significant nitrogen requirements of rice — mainly under the tropics — green manures of legumes have been used for a long time (DESAI—SESHAGIRAO 1957, STAKER 1958). Recently green manuring is more and more spreading also under the temperate zone (WILLIAMS et al. 1957).

Selection and way of growing of green manure crop depends generally on the climate and given soil conditions. In the tropics soybean, broad bean and different varieties of *Crotalaria* are used. These are sown in most cases on the moist stubble of the rice and after ploughing in the green manure crop, rice is planted out again on the area. In the USSR winter pea and vetch varieties are grown by preference for these purposes, mostly in crop rotations with very high participation of rice. In the fallow course of the crop rotation — after rice — a forage crop and subsequently a green manure plant is sown as a second crop and ploughed in the next spring under the rice.

As a result of this method excess yields of 30 to 40 per cent are reported (CHURIKOV 1948, NATALIN 1946). In Rumania varieties of vetch as well as soy bean and lupins are successfully employed (LUCA—VASILESCU 1959).

In Hungary where rice was grown in monoculture, the idea of green manuring of rice could not even arise. Subsequently to rice such winter ploughland is seldom obtained in which the green manure crop can be sown and gets so strong until the winter that it could supply a great green mass by the spring. If the green manure is grown as a main crop then one year's rice yield is lost which is not compensated by some weed killing effect of one year's dry cultivation. Considering that in the near future the major part of the rice crop in Hungary will be grown in crop rotation and so it would be possible to use green manuring, we thought it desirable to study the problem.

Experimental Procedure

Experiments were carried out at the Kopáncs station of the Research Institute for Irrigation and Rice Production in Szarvas, in the years 1958, 1959 and 1960.

The main characteristics of soil of the trial grounds are the following:

pH in water (0–20 cm)	8.06
Total salt content %	0.08
CaCO ₃ %	in traces
Humus content %	2.42
Total nitrogen %	0.15
Sticky point according to Arany	43

Data of temperature and sunshine during the vegetation period of the three years are presented in Table 1. In the experiments such course of crop rotation was taken as a basis in which the rice was preceded by a cereal and thus the green manure crop could be sown in September with certainty. The green manure crop was hairy vetch with rye in 1958 and a mixture of hairy vetch and barley in 1959 and 1960. As soon as soil was cleared of the cereal, stubble stripping and then autumn ploughing was conducted and sowing carried out in a well prepared seed bed between 15 and 20 September at the distance of drills usual for cereals. The proportion of vetch and cereal seeds was 2 : 1.

Until the onset of winter the stand properly strengthened and by the beginning of May the vetch was before flowering while the cereal directly before the emergence of the ears. Green yield was 200–260 q/ha and the roots of the vetch very rich in nitrogen collecting tubercles.

On one half of the field sown with green manure crop the crop stand was rolled and ploughed in while the other half cut to high stubble and the green mass fed up.

The rice experiments were established with the randomized block method with four replications on 100 sq. m. plots. Sowing was carried out with a 5.2 million/ha germ number at a distance of 12 and 24 cm between the drills from 15 to 20 May. In 1958 the varieties *Dunghan Shali* and *Precoce Allorio* while in 1959 and 1960 *Dunghan Shali* and *Uz-Rosz 17* were sown. During the vegetation period the usual water cover and care of plants was employed.

During the vegetation period the development of rice was followed with attention and yield factors as well as grain yield examined. Data are summarized in Tables 2, 3, 4 and 5.

Results and Discussion

From the data on temperature and sunlight presented in Table 1 it appears that during the vegetation period of the experimental years the temperature means were, nearly in every year, under the 50-year average. As to the number of sunlit hours the year 1958 was most favourable and 1960 most unfavourable.

Table 1

*Mean monthly temperature and number of sunlit hours during the vegetation period
(1958–1960)*

Year	May	June	July	August	Sept	Average
Temperature °C						
1958	19.0	17.0	20.8	21.7	16.3	19.0
1959	15.2	18.6	21.8	20.5	15.0	18.2
1960	14.9	19.2	19.3	20.2	15.0	17.7
50-year average (1901–1950)	17.2	20.4	22.7	21.7	17.7	19.9
Deviation from the average						
1958	+1.8	–3.4	–1.9	+-	–1.4	–0.9
1959	–2.0	–1.8	–0.9	–1.2	–2.7	–1.7
1960	–2.3	–1.2	–3.4	–1.5	–2.7	–2.2
Sunlit hours						
1958	308.8	240.0	353.9	313.7	233.7	1450.1
1959	259.0	274.8	278.4	275.6	224.2	1312.0
1960	174.7	265.0	197.7	293.9	156.1	1087.4
50-year average (1901–1950)	249.0	266.0	304.0	285.0	202.0	1306.0
Deviation from the average						
1958	+59.8	–26.0	+49.9	+28.7	+31.7	+144.1
1959	+10.0	+8.8	–25.6	–9.4	+22.2	+6.0
1960	–74.3	–1.0	–106.3	+8.9	–45.9	–218.6

From the periods of the phenophases of rice varieties (Table 2) per year and treatment the conclusion can be drawn that in the phases of tillering and panicle emergence — flowering under the impact of treatments only a difference of a few days arises while in the date of ripening the difference is much more important, 5–17 days. This difference subsequently to the ploughing in of the green manure crop (treatment No. 2) draws the attention to later ripening the result of which is a prolongation of the harvesting work and in most cases an increase of losses connected with harvesting. After the green manure stubble the difference in maturation of the rice varieties amounts but to a few days which from the viewpoint of harvesting is of no importance.

According to the average data of yield factors (Table 3) an important increase as against the control was obtained in panicle number per sq. m. both after the green manure ploughed in and the green manure stubble. Treatments 2 and 3 also increased the number of grains in panicles but this increase was accompanied by an increased per cent of sterility. Thus the sterility of panicles

Table 2
Dates of the major phenophases of rice varieties
 (1958—1960)

Treatment	Pheno- phase	1958		1959		1960	
		<i>Dunghan Shali</i>	<i>Precoce Allorio</i>	<i>Dunghan Shali</i>	<i>Uz-Rosz 17</i>	<i>Dunghan Shali</i>	<i>Uz-Rosz 17</i>
1. Control	I.	29.6	29.6	19.6	18.6	25.6	27.6
	II.	3.8	7.8	1.8	2.8	7.8	10.8
	III.	4.9	4.9	20.9	20.9	18.9	18.9
2. Green manure crop ploughed in	I.	25.6	27.6	19.6	17.6	23.6	25.6
	II.	29.7	4.8	5.8	9.8	6.8	9.8
	III.	17.9	21.9	25.9	29.9	26.9	25.9
3. Stubble of green manure crop ploughed in	I.	29.6	29.6	20.6	17.6	23.6	25.6
	II.	4.8	5.8	3.8	3.8	6.8	8.8
	III.	6.9	11.9	22.9	21.9	20.9	19.9

I. Tillering
 II. Panicle-appearance-flowering
 III. Ripening

Table 3
Yield factors of rice varieties in the mean of experimental years

Treatment	Variety	panicle/ sq.m.	number of grains/panicle		panicle steril- ity %	thou- sand grain weight g
			full	sterile		
1. Control	<i>Dunghan Shali</i>	172	58	3	5	30.5
	<i>Precoce Allorio</i>	167	71	5	6	31.1
	<i>Uz-Rosz 17</i>	159	86	5	5	28.1
2. Green manure crop ploughed in	<i>Dunghan Shali</i>	196	62	9	13	29.8
	<i>Precoce Allorio</i>	178	79	8	9	30.0
	<i>Uz-Rosz 17</i>	174	92	11	11	28.4
3. Stubble of green manure crop ploughed in	<i>Dunghan Shali</i>	188	66	7	9	30.7
	<i>Precoce Allorio</i>	182	81	6	7	31.2
	<i>Uz-Rosz 17</i>	177	96	7	6	28.5

amounted to 9—13 per cent after ploughing in green manure, 6—9 after green manure stubble and 5—6 per cent in control. As to the thousand grain weight the difference arising as an effect of treatments is practically not significant.

When evaluating grain yield in 1959 the yield of the variety *Dunghan Shali* had to be left out of consideration as considerable damage by *Piricularia* arose in this variety. Incidence was highly enhanced by the ploughing in of green manure.

On the basis of the yield (Table 4) it can be established that both ploughing in of green manure and green manure stubble resulted in a significant surplus yield. The ploughing in of green manure increased yield by 12–19 per cent while green manure stubble by 9–13 per cent. This surplus yield arose mainly from the excess number of panicles per unit area (Table 3).

No significant difference in yield appeared between the row-width of 12 and 24 cm.

When evaluating the three treatments examined (Table 5) from the crop yield of years and varieties we can establish that the ploughing in of green manure resulted in a surplus crop yield of 16 per cent while green manure stubble caused a 11 per cent surplus. In ultimate analysis the yield increasing effect of green manure stubble is only 5 per cent less than that of the underploughed green manure, but the great amount of valuable spring green fodder amply indemnifies for this difference. It seems therefore a better paying proposition instead of ploughing-in the full green mass to feed it up as fodder and sow the rice in the underploughed stubble. In crop rotations where rice is preceded by cereals, seeding of autumn fodder mixture does not cause special trouble and even planification of fields can be readily carried out before sowing. Against the ploughing-in of the green mass argues also the fact that green manure renders the stand of rice more luxuriant which in varieties susceptible to *Piricularia* — such as *Dunghan Shali* — when other predisposing factors appear aggravates the damage. In the green manure stubble, on the other hand, no overdevelopment of rice was found. Further advantages of the method are the increase of the nitrogen supply of the soil in an inexpensive way and some weed killing effect.

Conclusions

In the Kopáncs station of the Research Institute for Irrigation and Rice Production at Szarvas, in the years 1958, 1959 and 1960 green manuring experiments were conducted for rice.

As green manure crop hairy vetch with rye and barley respectively were used, sown in the autumn of the year preceding the seeding of rice and ploughed under the following year in May or utilized as fodder.

Treatments used were the following: 1. control without green manuring, 2. green manure crop ploughed in and 3. stubble of green manure ploughed under.

In the experiments the rice varieties *Dunghan Shali*, *Precoce Allorio* and *Uz-Rosz 17* were sown with a row-width of 12 and 24 cm.

During the vegetation period of rice the dates of the phenophases and at ripening the factors of yield and the grain yield were examined.

Table 4
Grain yield of rice varieties per treatment and year

Treatment	Row width cm	1958				1959		1960			
		Dunghan Shali		Precoce Allorio		Uz-Rosz 17		Dunghan Shali		Uz-Rosz 17	
		q/ha	relative number	q/ha	relative number	q/ha	relative number	q/ha	relative number	q/ha	relative number
1. Control	12	29.4	100	25.2	100	27.8	100	31.8	100	29.6	100
	24	30.1	100	24.4	100	26.9	100	32.7	100	29.4	100
2. Green manure crop ploughed in	12	34.4	117	30.1	119	32.5	116	35.8	112	34.2	115
	24	35.8	118	28.5	117	32.3	119	37.0	113	33.0	112
3. Stubble of green manure crop ploughed in	12	32.3	110	28.5	113	30.9	111	34.9	109	32.7	110
	24	34.2	113	27.7	113	30.3	112	36.3	111	32.2	109
L. S. D 5% between combinations			3.1				2.6				2.3

Table 5
Summarized crop yield of treatments from the average of varieties and years

Treatment	Crop yield q/ha	Relative number
1. Control	28.73	100
2. Green manure ploughed in	33.36	116
3. Green manure stubble	32.00	111
L. S. D. 1%	0.49	
5%	0.67	

On the basis of data it has been established that the ploughing-in of green manure retarded ripening, increased the number of panicles per sq. m. and the number of grains in the panicles but at the same time reduced fertilization. After the green manure stubble the injurious effects are of minor importance (Tables 2, 3).

Average crop yields changed by years and varieties but both the ploughing-in of green manure and green manure stubble caused a significant excess yield (Table 4). In the average of years and varieties the ploughing-in of green manure caused 16 per cent surplus yield, green manure stubble 11 per cent as compared with the control. Since after the green manure stubble ripening of rice is not retarded and a great amount of spring green fodder is obtained, it is economically more efficient to utilize the green mass as fodder instead of ploughing-in the green manure.

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CALLUS-HISTOLOGICAL EXAMINATIONS ON THE CUTTINGS OF HERBACEOUS AND WOODY HORTICULTURAL PLANTS

By

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Comparative histogenetical investigations have been conducted on herbaceous and woody plants propagated from cuttings and used in horticultural practice to establish whether the development of callus tissue necessarily precedes, on the area of the wound, the formation of organs and to answer the question whether organs can be brought into being from the tissue. My examinations have shown that development of organs may start independently of the formation of callus tissue. This is particularly frequent in herbaceous plants but occurs also in woody plants. No organization of organs or roots was observed either in the callus tissue of herbaceous or of woody plants.

Introduction

The most frequently used histological notion in horticultural practice and special literature is callus. In connection with the rooting of cuttings — starting from the erroneous belief that roots originate from the callus — great importance is attached to this tissue.

From earlier investigations (GÖRGÉNYI 1960, 1961) conducted on a few woody plants I came to conclusions that contradict in many respects the opinions widespread in practice. I have observed that organization of roots from shoots takes its origin not from callus tissue but from the old tissues of the mother plant and that they can develop often prior to callus formation and even in total absence of the latter. In the present work I intended to enlarge the scope of my earlier investigations and mainly to extend them to several herbaceous and woody plants propagated in horticultural practice by cuttings. By the examination of a greater amount of material we can get nearer to the solution of dubious problems and by comparisons we can more readily point to conclusions of general validity or to deviations.

To raise this question was also justified as literary data reveal different opinions. Works following rather physiological experimental line and supported by only few anatomical data such as VÖCHTING (1878), TITTMAN (1895), SIMON (1908) and BÜNNING (1953) state that roots originating from shoots can differentiate also from the callus, while communications relying exclusively on anatomy (STOLL 1874, GRAEVNITZ 1913) take the stand that roots originating from the shoot can be organized only from the old tissues of mother plant.

Beside the main theme some minor issues also arose in the course of work. Since it has been known already from older literature (STOLL 1873) that there is a difference between the callus tissue development of woody and herbaceous plants, the question arises how far this difference goes and how far the wound cambium is capable of activity in the one group and in the other and finally what histological differences can be observed between the callus tissue of woody and herbaceous plants.

Material and Method

As for experimental material I have chosen from herbaceous plants the cultivars of the following species: Hybrids of *Ageratum corymbosum* Zucc., *Begonia* cv. *Gloire de Lorraine*, *Coleus blumei* Benth., *Chrysanthemum indicum* L., *Dahlia variabilis* (Willd.) Desf., *Iresine Herbstii* Hook., *Salvia splendens* Sello, *Impatiens sultani* Hook., *Lantana camara* L., *Pelargonium zonale* hort., while from woody plants *Ribes nigrum* L. and *rubrum* L., *Cydonia oblonga* Mill., *Forsythia suspensa* (Thunb.) Vahl, *Deutzia crenata* Sieb et Zucc., *Philadelphus coronarius* L., *Juglans regia* L. — the cuttings of herbaceous ornamental plants were collected continuously, as required by their development from a propagation ground of the Horticultural Establishment of Budapest. Woody plant cuttings were made available by the Research Institute of Horticulture. The material collected was elaborated with microtechnical methods in use.

Results and Discussion

For a start, the herbaceous plants have been investigated. In the course of work it has soon appeared that even the herbaceous species examined do not behave uniformly in every respect. They include quite simple and very complicated cases. I shall not deal separately with the species enumerated but rather with groups of those behaving similarly. Proceeding from the simpler cases towards more complicated ones about four groups can be differentiated.

1. The simplest way of regeneration of the wound area is the suberization of the non destructed cells, e.g. in the species *Iresine* and *Impatiens*. Suberization can be observed as early as the second-third day after layering. Epidermis, primary cortex, living cells of vascular tissues and the cell walls of the extensive pith continue to thicken to a lesser degree and in accordance with microchemical reactions cork substance is deposited into the cell wall. Suberization proceeds from outwards to inwards and extends to about 4—6 cell rows inwards. At the same time upwards to 500—600 μ from the wound area a rapid differentiation of the root growing points starts from the pericyclic zone above the bundles. In these species the development of the new organ has started without the formation of callus tissue on the wounded area (Fig. 1).

2. In the major part of the material examined, however, callus is developing during rooting. In juicy plants with extensive pith it is particularly frequent that the pith sinks strongly in or bursts out in the middle and thus on the sur-

face of the cut a deeper cavity develops as in the *Coleus*, *Salvia splendens*, *Dahlia variabilis*, *Ageratum corymbosum* species. Since here rather young plant parts are involved, all of living cells transform, on the whole cutting surface, into wound callus able to divide. The cambium section placed among the vascular tissues beings to divide in a rapid rhythm with periclinal walls, to which the pith dividing actively with radial walls is archlike attached while finally cortex cells join the divisions. The division intensity and direction line

IRESE Herbstii

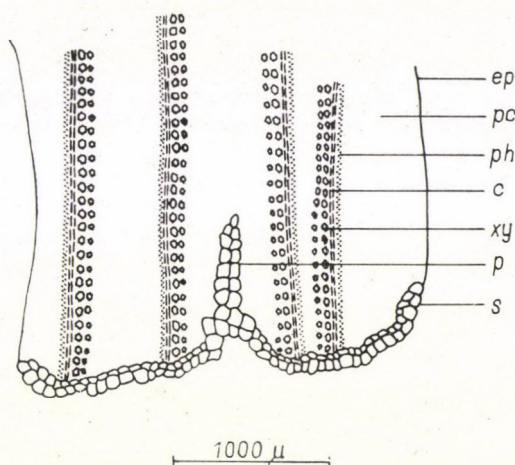


Fig. 1. Longitudinal section from an *Iresine Herbstii* cutting. ep = epidermis, pc = primary cortex, ph = phloem, c = cambium, xy = xylem, p = pith, s = suberized wound surface cells

of wound cambium developed from different tissues being, however, qualified as uniform, is different. In medullary zone the wound cambium abstricts generally little callus tissue (5 to 6 cell rows) with radial walls and only in one outward direction. These cells rapidly increase, dispose of a large vacuole and stabilize. The outward cells get round off, some of them show a cystiform elongation as if they turned into absorbing cells. The division of cambial zone transformed into wound cambium is more intensive. The cambium continues to retain its two-way division with periclinal walls, although abstricting no more vascular elements but doing so with parenchymatous cells that stabilize rapidly. The result then is that on the periferial part of the cutting callus formation is more intensive than in the medium zones. The developed tissue is not arranged in such uniform rows either as in the medullary zone but cell rows bending, archlike, outwards and inwards take shape. The activity of the wound cambium is not of long duration, it lasts only a few days, as long as the first roots appear. The wall of the cystiform elongated external cells of the

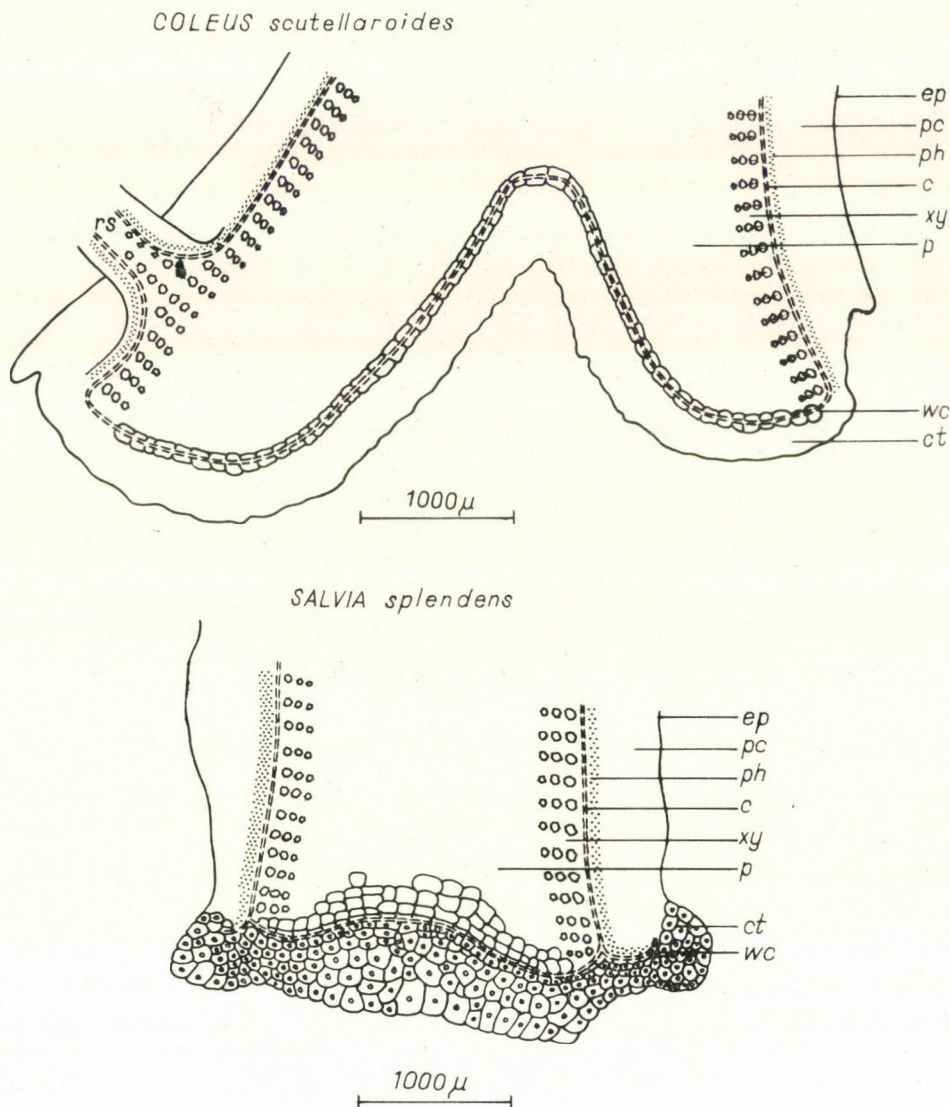


Fig. 2—3. Longitudinal section from *Coleus Blumei* and *Salvia splendens* cuttings. ep = epidermis, pc = primary cortex, ph = phloem, c = cambium, xy = xylem, p = pith, ct = callus tissue, wc = wound cambium, rs = root of shoot origin

callus gets suberized then compressed and hereby the activity of the wound cambium comes to an end.

Simultaneously with the activity of the wound cambium (the second to third day of layering) differentiation of roots of shoot origin sets on. The growing points of the root appear densely beside and above each other at 300—400 μ from the surface of the cut but farther away in the whole internodium

they start to develop almost at the same time in the pericyclic zone above the bundles (Fig. 2—3).

3. Callus formation follows again a different pattern in case of *Chrysanthemum* and *Lantana*. While in the former species regeneration starts on the area of wound, within one or two days after layering in these species the procedure may be kept on for one or even two weeks. During this period the living cells of the wound surface and particularly those of the extensive pith and cortex decay when proceeding to several cell rows inwards and above the decayed part of tissue living cells regain only seldom their capacity of division. Therefore, the case is more frequent when, above the decayed medullary cells, neither wound cambium nor callus develops. On the cut surface only the cambial section produces callus. Thus, on the periferial part of the wounded surface only the ring of callus cells abstricted by the two-way division of the cambium is seen. The cells of callus tissue are thinwalled, their plasm gets absorbed within a short time, their external cell rows get suberized and hereby the wound cambium finishes its short activity. Having examined several hundred cuttings in the case of *Chrysanthemum* the experience was gained that the organization of the growing points of roots preceded in almost every case callus formation and it even frequently occurred that the whole intermedium became rooted without callus formation. The callus formation in both species as well as the organization of their roots of shoot origin reminds of what was found in woody plants i.e. the roots of shoot origin begin to develop in the cambium sector of the pith rays (Fig. 4—5).

4. The regeneration pattern of the cuttings of *Pelargonium zonale* is almost unique in its kind; no similar case has been noticed. First of all it should be noted that in these cuttings starch stored is found abundantly which was less observed in the plants discussed so far. The cut surface in cuttings of several days, even weeks is macroscopically of light yellow colour, strongly undulated, as if a great many growing points broke out of cut surface.

Microscopical examinations, however, exhibit a different picture. Some days after layering, probably as a result of water absorption and the breaking down of stored starch tissue regions strongly swell and the tissues of unequal osmotic value detach themselves from each other. Thus in the cambium, cortex and pith several rifts arise. On the surface of cut torn apart before any wound cambium could form in the wall of exterior cells a cork substance deposits and the epidermis, cortex, pith and what is most interesting also the cells of the cambium become suberized. Thus this cut surface strongly chapped is protected by a cork tissue of one or several cell rows. When in the mean time the organization of the root apices has set on, the protection of the outer surface having been assured already by the developing cork layer, further suberization comes to an end. More frequently, however, immediately above the cork tissue and along the tear in the tissue a wound cambium develops as well which, in my

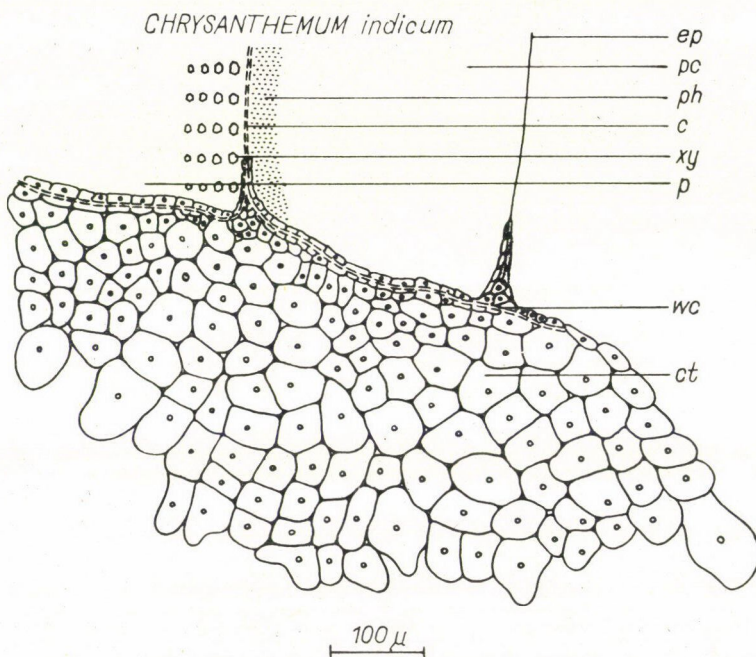
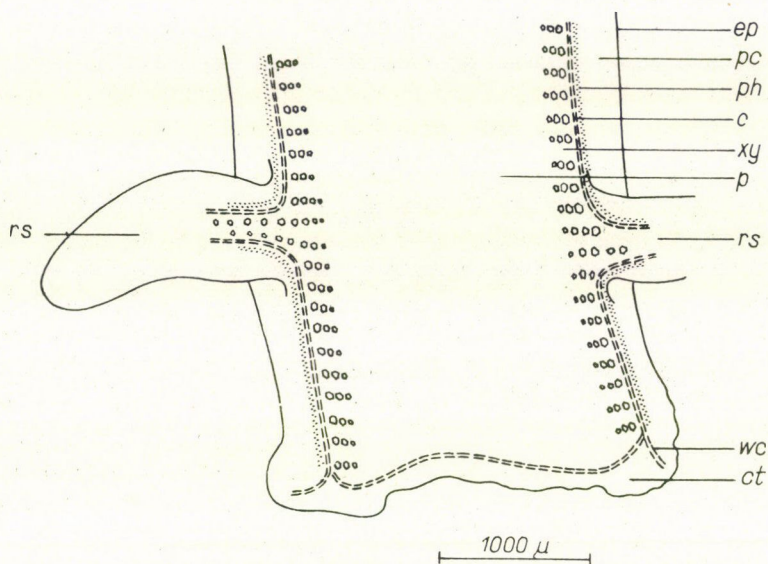
CHRYSANTHEMUM indicum

Fig. 4–5. Longitudinal section from *Chrysanthemum indicum* cutting. ep = epidermis, pc = primary cortex, ph = phloem, c = cambium, xy = xylem, p = pith, ct = callus tissue, wc = wound cambium, rs = root of shoot origin

opinion could be qualified rather as a dipleurically functioning cork-cambium. This abstracts inwards, in regular rows, living cells of ground tissue while outward it does the same with cork tissue. Parallel with this procedure the organization of roots of shoot origin is going on. And here I encountered the case observed also in *Begonia* leaf cuttings, i.e. the roots of shoot origin did not appear through the side of the cutting but reached the surface through the

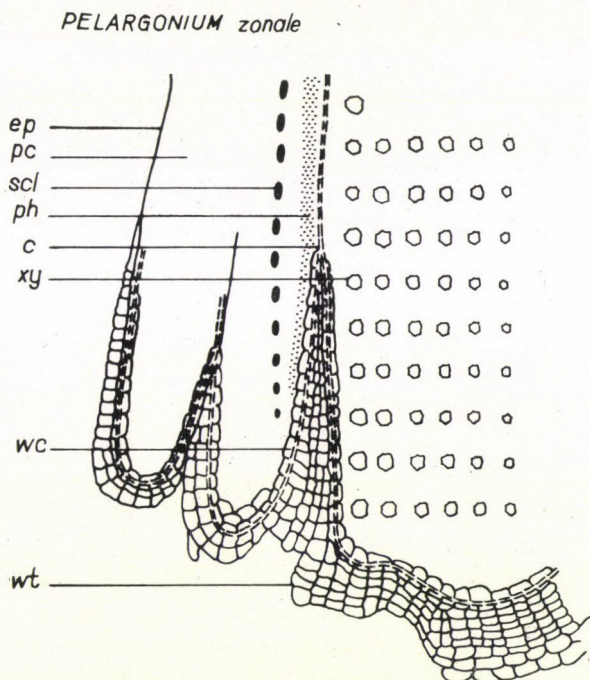


Fig. 6. Part of longitudinal section from *Pelargonium zonale* cutting. ep = epidermis, pc = primary cortex, scl = sclerenchyma, ph = phloem, c = cambium, xy = xylem, wc = wound cambium, wt = wound closing cork tissue

callus. Examining their origin, however, I found them not to be differentiated from the callus but initiated from the old tissues of the mother plant, particularly from the pith ray sector of the cambium. Bearing in mind the polarity of the root and the innumerable rifts on the cut surface it seems probable to be easier for the root to break through the basal part mechanically than laterally where it must be also taken into consideration that a consistent sclerenchyma tissue ought to have been broken through (Fig. 6).

The procedure of wound closing on the wound area of woody plants is more complicated. It is uniform so far as only the function of wound cambium originating from the cambium can enter into consideration, while the activation of other living cells is not significant. A substantial difference consists,

however, in the fact that here this procedure may be protracted for a long time and the original callus tissue originated primarily during this time may suffer — secondarily — important changes. From the woody plants I shall discuss some simpler cases in connection with callus tissue development of cuttings of *Cydonia*, *Forsythia*, *Deutzia*, *Philadelphus*, *Ribes nigrum* and *rubrum*. In these species the procedure of callus formation is very similar, differences arise more in time. The cambium of cutting material discontinues its activity for a shorter or longer period after layering and then begins to divide more rapidly in *Ribes*, *Forsythia* and *Philadelphus* in a slower rhythm in *Deutzia* and *Cydonia*. In the radial longitudinal sections it is readily seen that by the division of cambium a new tissue portion is inserted cuneiformly widening between xylem and phloem. Divisions take place first according perfectly to the pattern characteristic of cambium with periclinal walls. The gradually increasing portion of tissue protrudes to the surface. Its interior cells strongly increase, they are thin-walled but continue to contain plasma for a certain time. At the circumference of the protruded portion of tissue the wound cambium clearly visible and forming the direct continuation of cambium will soon separate and continue to function. Keeping on its two-way division it increases inwards the inner portion of tissue similar to the ground tissue and outwards the surface layers are going to stabilize and cork material is deposited in their cell wall. Upon the pressure of the interior tissues they somewhat elongate tangentially, then the exterior ones round off and even wear down. In the initial stage of development the portion of tissue within the wound cambium consists of simple parenchyma cells. The cells, however, stabilize soon, some continue to contain plasma while others elongate a good deal their plasma being absorbed, their cell walls thicken reticularly and in the end differentiated to simple water transporting cells. Depending on the species involved, whether its rooting lasts a longer or shorter time, the wound cambium goes on increasing with slow division the tissue closing the wound. In *Forsythia*, *Philadelphus* and *Ribes* while rapidly rooting also the wound cambium abstricts in a quick rhythm a callus tissue of looser substance and in *Cydonia*, on the other hand differentiates — much slower — a compact dense callus tissue.

It is only too natural that if this developmental process is not observed gradually in its evolution, it is in no way so simple as that. The sections of the older callus surfaces show a very complicated picture, particularly when under the pressure of the new portion of tissue inserted outwards of the cambium in the cortex several tears arise where a new wound cambium may develop with new callus tissues. At other instances especially the interior tissues may be pressed together until they are irrecoznizable or they decay. In the case of *Forsythia* and *Philadelphus* the extensive pith consisting of dead cells gets torn upside down (Fig. 7).

In none of the species did the organization of the roots start from the callus. In *Ribes nigrum* and *Ribes rubrum* it started partly from the latent root primordia and partly from the cambial section of the primary pith rays. In *Forsythia* and *Philadelphus* they initiated in the stem parts below the bud also from the cambial section of the primary pith rays while in *Cydonia* in the stem part above the bud from the cambial zone of the wide pith ray originating at the emergence of leaf trace bundles.

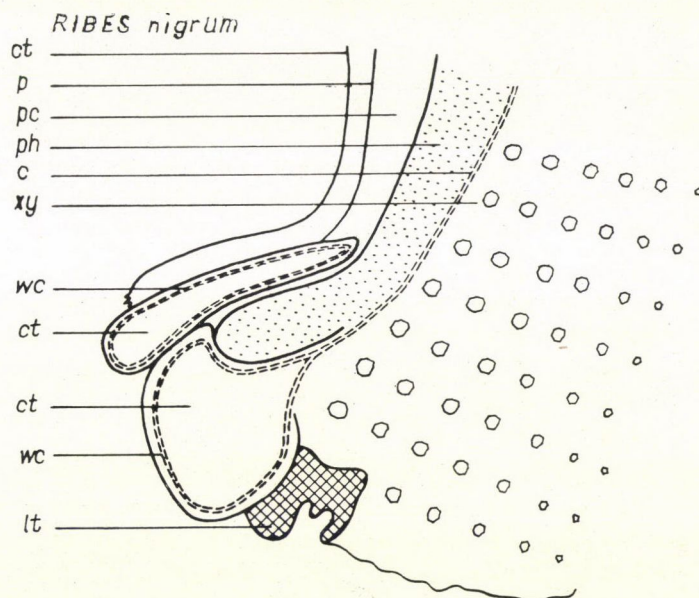


Fig. 7. Part of longitudinal section from *Ribes nigrum* woody cutting. ct = cork tissue, cc = cork-cambium, pc = primary cortex, ph = phloem, c = cambium, xy = xylem, wc = wound cambium, ct = callus tissue, lt = looping tissue part

The root-true propagation method of walnut in the vegetative way was experimentally investigated by ZATYKÓ (1948). The young walnut saplings are strongly incised near the ground and then filled up. The incised tongue-like part is rooting after a certain time. These incised parts were examined. On the surface of cut during the rooting process which takes several weeks a vast callus develops. In this species we are confronted with the most complicated histogenetical process. Only after long examinations did the proper explanation develop, showing which tissues of the saplings of often 2—4 cm diameter continue to function and how as a result of artificially changed conditions.

In the older material it is almost impossible to recognize this, so let us briefly inspect the process of development. Once propagation is accomplished changes have been on the surface of cut caused for several days and even weeks only by the decay of the living cells of the wound surface. Not only

the living cells of the external surface decay but the lifeless elements of the deeper layer assume gradually a brown colour. Thus the surface of cut is surrounded by a decayed layer. After a short while the protracted division of the cambium indicates that the regeneration process has set on. The cambium, similarly as in the non disturbed tissues before incision, abstricts cells in two

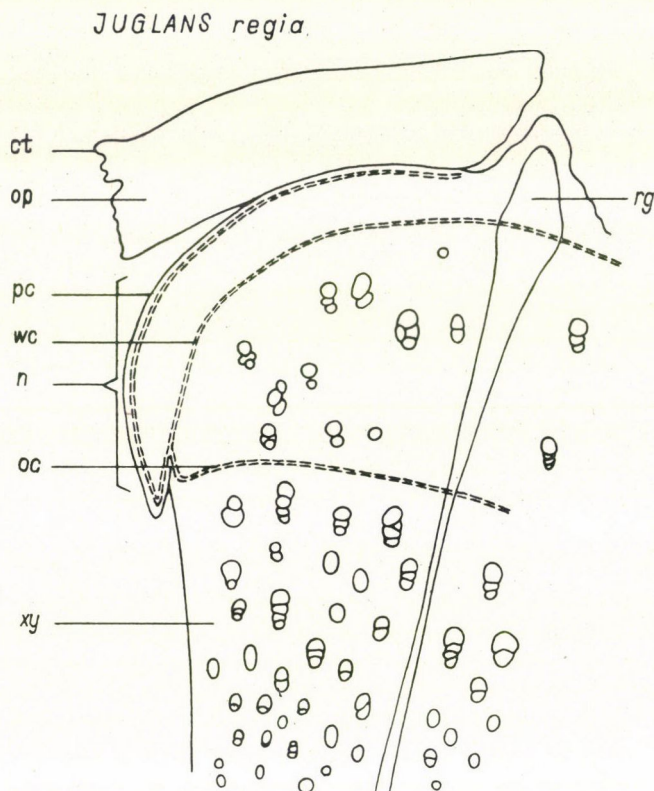


Fig. 8. Cross section from a sapling used as *Juglans regia* cutting. ct = cork tissue, op = original primary cortex becoming detached, n = newly developed part of tissue, wc = wound cambium, cc = cork-cambium, oc = old cambium, xy = xylem, rg = root growing point

directions and even the relative amount or mass of abstricted cells corresponds with the function of healthy cambium as a tissue develops corresponding to xylem inwards and to phloem outwards. The cells of tissue differentiated inwards are generally of great lumina and of parenchymatous character. In the course of time, however, some of these cells will reticularly and pittedly thicken, elongate, get perforated and transform into tracheae and even twin pores so characteristic of walnut will develop in this tissue. As compared, however, with the xylem part developed under ordinary conditions a completely different tissue appears which is in no way similar in structure, only

some elements remind of the xylem of normal development. It contains many parenchymatous elements with great lumina and few vascular and supporting tissues. The elements of tissue abstricted outwards and thus homologous with phloem are of small lumina and thin-walled. It contains also many parenchymatous elements but the sieve tubes with their accompanying cells can be recognized too. Above the newly developed tissue the rests of the former phloem and cortex are, of course, still present but they are highly compressed and as a consequence of the incision torn off. Anyway they can assure the protection of the new tissue portion for a time. After a certain period, however, in the superficial cell rows of the new cortex portion a newly developed paracambium begins as well its activity. In the ultimate analysis the new tissue portion is increased by two cambiums, until more intensive rooting sets on.

Parallel with the long wound closing procedure the organization of roots of shoot origin also begins. Starting from the old annual ring limit broader pith rays widen in the shape of a funnel. The cells of tissue portion of greater mass and elongated in radial direction do not divide right at the beginning but later they continue to divide independently and on the apical part of the broad meristematic tissue part gradually a root growing point is gradually developing. Thus the growing points of roots differentiate also on this species from the old tissues of the mother plant (Fig. 8).

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DATA ON THE POSSIBILITIES OF CONTROLLING POTATO VIRUS

II. EXPERIMENTS WITH THE GERMAN METHOD AND THE IMPROVED GERMAN METHOD

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The present article has treated the German and the improved German methods and examined the extent to which they are suitable for maintaining or improving seed potatoes. The results show that the German method has generally resulted in the reduction of the virus infection of seed potatoes and of those of the second season.

The virus infection of seed potatoes produced by the improved German method was reduced even during the second season of testing.

Introduction

In my previous study (HORVÁTH 1966) I treated the general possibilities of controlling potato viruses. Here I am concerned with the production of healthy seed potatoes through the German method (GOERLITZ 1955, KLINKOWSKI 1960, KLINKOWSKI—KEGLER 1961, cf. SCHWEIGER 1962, cf. SCHÜLLER 1963). This method differs from the customary practices of potato production in so far as the sick or infected plants are rogued during the growing period and the seed producing plot is isolated. But since this method provides an almost unlimited opportunity of transmitting viruses mechanically during the agrotechnical work and even of the spread of viruses by vectors from exogenous and endogenous sources, it cannot be regarded as a really effective one.

According to data furnished by BAER—RÉTHY (1960), selection can improve, in the course of producing seed potatoes, the unfavourable situation whenever the yields of plants tolerant to certain viruses are hardly reduced or the sizes of the seed potatoes surpass those of the healthy plants. Selection is important not only for removing virus-infected plants but also for choosing virus-resistant plants during plant improvement (CLOSE 1961, ATANASOFF 1965). As part of an intensive plant cultivation project the selection of infected and underdeveloped plants [*Phytophthora infestans* (Mont) de Bary, *Erwinia atroseptica* (van Hall) Jennison, *Erwinia caratovora* (Jones)] is one of the fundamental conditions for the production of good quality seed potatoes (SCHWEIGER 1962, GALL et al. 1964, a written communication from HINFNER, 1965).

Among the rules of selection reducing the spread of potato viruses the roguing of weeds as virus carriers has to be mentioned since it has been experimentally proved — in opposition to the data of KAPICA—ANDREEVA (1962) — that weeds may carry potato viruses (KLINKOWSKI 1960, HORVÁTH 1962, AMBROSOV—GREBENSHTSSIKOVA 1964). Herbicidal research in connection with potatoes has been rather successful in recent years with chemicals of selective effect (cf. BURCHAUSEN 1963).

According to the improved German method (SCHLEUSENER 1953, cf. SCHWEIGER 1962), which has been coming into general use today, seed potatoes are forced, planted early and selected several times during the growing period. This method is a significant advance in the production of healthy seed potatoes because an important selection takes place during forcing. Due to the stronger and faster development, plants reach a stage of resistance by the time. The exogenous aphid infection starts while, on the other hand, repeated selection among the plants reduces the possibility of endogenous infection. Forcing — independently of the region — increases the yield and does not affect the starch and protein content of the tubers (GOERLITZ 1963, SUVAYJIK 1963, RENE—MAN 1963).

Materials and Methods

Our experiments have been made with potato varieties described in a previous article (HORVÁTH 1966). In both experiments the different potato varieties were planted in 100-hill units having seven treatments and four replicates at the Experimental Station of the Keszthely College of Agriculture in 1962.

To examine the German method the different potato varieties were planted on April 24th and 25th without any previous treatment.

On studying the improved German method potato varieties were forced. Forcing was done with an artificial illumination consisting of four 250 W crosslights and one 500 W ceiling light in an 8 m² room. The work began on February 14th. Temperature was automatically maintained at 15° C and the even circulation of heat was obtained by two fans. Forcing ended in the first week of April when the sprouts reached 3—4 cm in length. Because of late spring the planting of forced potatoes was done on April 9th and 10th following a selection of the tubers.

Results and Evaluation of the Experiments

In 1962 I determined the virus infection of the different varieties, the correlation of yield and the size of the tubers. I also included a study of aphids as virus vectors as well as a determination of the water, dry-matter and sugar contents of the varieties.

1. German method

a) Virus infection

Examinations by the German method have proved only partially the results of the 1961 autumn studies of tuber-index of potatoes. During the second season of testing (1962) the virus infection of *Somogyi Kifli* was in-

Table 1
Comparison of the general virus infection of potato varieties

Variety	Virus examinations ¹⁾ (Average occurrence of PVX, PVY, PVS, PLRV, in %)		
	1961		1962
<i>Somogyi Kifli</i>	26.5 ^{a)}	8 ^{b)}	14/24 ^{c)}
<i>Gölbaba</i>	35.7	18.7	56.3/63
<i>Kisvárdai Rózsa</i>	29.6	11.7	60.1/68
<i>Mindenés</i>	23.7	10.7	11.1/20
<i>Somogyi Korai</i>	21.8	11.5	8.8/18
<i>Somogyi Sárga</i>	21.8	8.7	7/22

Note: 1) PVX = Potato virus X
 PVY = Potato virus Y
 PVS = Potato virus S
 PLRV = Potato leaf-roll virus

- a) General virus infection of the potato varieties before selection.
 b) General virus infection of the potato varieties after selection (based on the autumn examination of tuber-index of seed potatoes).
 c) The numerator indicates the virus infection of the individual potato variety, while the denominator the percentage of selected plants.

creased by 6%, *Mindenés* by 0.4% while in case of *Somogyi Korai*, *Somogyi Sárga* it was reduced by 2.7% and 1.7% respectively in comparison to the results of studies on tuber-index of potatoes carried out in 1961 (Table 1). The index of virus infection of two varieties (*Gölbaba*, 56.3%, and *Kisvárdai Rózsa*, 60.1%) shows that the very high values of 1961 (143 and 118.5 respectively prior to selection) can hardly be reduced even if the most careful methods of selection are used. During the 1963 planting the virus infection of the different varieties increased even more, especially those of potato virus Y (=PVY) and potato leaf-roll virus (=PLRV) did so (Table 2). Selection generally reduced the virus infection of the different varieties (Table 2). It should be noted that some of the varieties (Table 2) had a reduced infection of potato virus X (=PVX). There was a great reduction of PVY only in case of *Somogyi Kifli*, *Mindenés* and *Somogyi Korai*, while there was also a reduction of PVX among these three varieties. The greatest reduction of PLRV has occurred in *Mindenés*, but the results are far from satisfactory (Table 2).

It should be remembered that the number of healthy plants has been increased by selection. Favourable results were obtained in case of *Kisvárdai Rózsa* and *Gölbaba*. These values are only relatively high because they appear low in comparison to the absolute health index of the other varieties. This is especially apparent when studying the low decrease of the virus infection

Table 2

*Average virus infection of potatoes during the examination of the German method
(Including complex virus forms, healthy plants, and index of infection)*

Variety	Average results of examination in %				No. of healthy plants %	Complex virus forms %	Index of virus infection
	PVX	PVY	PVS	PLRV			
<i>Somogyi Kifli</i>	6 ^{a)}	10	32	15	45	9	63
	15/2 ^{b)}	33.5/3	32.5/33	25/2	33/71	20/5	106/40
	-60 ^{c)}	-70.2	-1.6	-40	+36	-55	-40.6
<i>Gülbaba</i>	21	8	55	19	20	28	103
	22/16	12.5/4	69.5/46	39/9	9/46	48/13	143/75
	-4.6	-36	-20.9	-51.3	+122	-34.9	-28
<i>Kisvárdai Rózsa</i>	12	16	31	25	33	20	85
	13.5/10	9/7	39/20	57/10	12/69	32/11	118.5/47
	-3.8	+82.3	-20.6	-56.2	+175	-37.5	-28.3
<i>Mindenes</i>	3	2	38	5	64	2	48
	8/2	5/0	59/40	23/1	32/58	29/1	95/43
	-62.5	-60	-35.6	-78.3	+100	-93.2	-49.5
<i>Somogyi Korai</i>	3	2	35	3	70	4	43
	11.5/2	13.5/2	48.5/38	14/4	30/60	19/2	87.5/46
	-74	-85.2	-27.9	-78.6	+133	-79	-50.9
<i>Somogyi Sárga</i>	5	8	29	11	58	5	53
	10/4	11/2	35.5/26	31/3	35/74	17/6	87.5/35
	-50	-27.7	-18.4	-64.6	+65	-70.6	-39.5

Note:

a) Results of the 1963 examination.

b) The numerator indicates the figure for 1961 previous to selection, while the denominator contains the results, after selection, of examinations on tuber-index of potatoes, i.e., the occurrence of viruses.

c) The figures indicate in percentage the reduction of viruses, complex virus forms, virus infection by selection (—) or the increase of healthy plants (+).

values (*Gülbaba*, 28%, and *Kisvárdai Rózsa*, 28.3%) and in case of complex virus forms (*Gülbaba*, 34.9%, *Kisvárdai Rózsa*, 37.5%).

It can be generally stated that even high values of selection — being otherwise impracticable in actual production — could not totally eliminate the occurrence of viruses among seed potato stock. It is unlikely that further selections in succeeding years would have improved the situation for the *Gülbaba*, *Kisvárdai Rózsa* and *Somogyi Kifli* varieties. The virus infection of the original stock and the occurrence of complex virus forms were too high with these three varieties.

b) Yields

In examining the production yields of the potato varieties it should be mentioned that the average yield per plant was reduced by eight decagrams and that in the 1963 planting, the yields of two varieties, *Kisvárdai Rózsa* and *Gülbaba* were already reduced by 20 and 10 decagrams respectively. During the virus studies these two varieties exhibited the highest infection values and the number of healthy plants was also low (Table 3). During the 1962 season *Somogyi Kifli* had an eight decagram increase in yield, but in 1963 the yield was reduced by ten decagrams in comparison to that of the previous year. A better yield was produced by the *Mindenes*, *Somogyi Korai* and *Somogyi Sárga* varieties which had a relatively low index of infection. Only the yield of *Somogyi Korai* was reduced by one decagram in comparison to that of the previous year, but in 1963 this figure rose by four decagrams. In 1962 the yields of *Mindenes* and *Somogyi Sárga* increased 13 and 11 decagrams respectively, but in 1963 *Somogyi Sárga* was reduced from 96 to 85 decagrams and *Mindenes* dropped from 99 to 90 decagrams per plant. It should be noted that in case of *Somogyi Kifli*, *Gülbaba*, and *Kisvárdai Rózsa* where the yields had uniformly declined (with the exception of *Somogyi Kifli* in 1962), reduction in the size of the tubers was from +1.8% (minimum) to +7.1% (maximum) in comparison to the figures of 1961 (Table 3). Simultaneously in case of *Mindenes*, *Somogyi Korai*, *Somogyi Sárga* where there was no decrease in yield (with the exception of *Somogyi Korai* in 1962) tubers in the 40–60 mm category increased by +5.8%. The minimum increase in the category of 60–80 mm was +1% and the maximum was +3.4%, while for the tubers over 80 mm the minimum increase was +1.5% and the maximum was +2.5% (Table 3).

Of course the spread of viruses is not solely responsible for the yield conditions, temperature, precipitation, etc. are also significant.¹⁾

¹⁾ PÄTZOLD—STRICKER (1964) proved that the water supply in the weeks following sproutings was the most important for the setting of the tubers because setting began on the twentieth day after germination. But if the moisture supply is adequate, the temperature conditions of the first fifty days do not affect setting.

Table 3

Yields of the different potato varieties in respect to the standard grading of tubers (German method)

Variety	Average yield per plant in decagrams 1962	The various grades of produced tubers (%), 1963 ⁽¹⁾ and deviation from the data of 1961 ⁽²⁾										Quantity of yield in quintals/cadastral acre 1961/1963
		0—34 mm		35—79 mm		80—100 mm		101—120 mm		above 121 mm		
		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	
<i>Somogyi Kifli</i>	38 ^{a)} —8/—10 ^{b)} —2 ^{c)}	20.5	+3.2	65.8	+7.1	8.2	—3.3	4.5	—6.2	1.	—0.8	70.46/65.76 —4.70 ^{d)}
<i>Gülbaba</i>	17 +8/—2 —10	21.5	+2.0	65.0	+2.2	8.0	—4.1	3.0	—0.5	2.5	+0.3	58.72/35.23 —23.49
<i>Kisvárdai Rózsa</i>	72 +8/—12 —20	30.5	+1.8	63.7	+4.6	4.1	—5.7	1.5	—0.7	0.2	—0.2	187.90/140.92 —46.98
		0—39 mm		40—60 mm		61—80 mm		above 81 mm				
<i>Mindenes</i>	99 —11/—9 +2	34.5	—6.5	55.2	+5.8	8.6	+1.0	1.7	+1.5	.....	.....	206.88/211.39 +4.51
<i>Somogyi Korai</i>	69 +1/—6 +3	36.9	—6.3	47.5	—4.1	13.6	+0.9	2.0	+1.5	.....	.....	140.92/147.97 +7.05
<i>Somogyi Sárga</i>	96 —13/—11 +2	26.0	—3.5	60.2	—4.4	10.7	+3.4	3.1	+2.5	.....	.....	194.95/199.64 +4.69

Notes:

a) Average yield of 1962 in decagrams.

b) The numerator contains the deviation in yield for 1961 (in decagrams per plant) while the denominator the deviation for 1963 (decagrams per plant.) (Figures are compared to those of 1962.)

c) Deviation of the 1963 yield (in decagrams per plant) from the results of 1961.

d) The mean deviation between the yields of 1961 and 1962 in quintals per cadastral acre (= Hungarian acre or 1.42 acres).

Table 4

Mean monthly temperature and total precipitation showing the deviation from the
40 year average at Keszthely¹⁾
(1901—1940)

Year	April	May	June	July	Aug.	Sept.	Total aver. (Apr.—Sept.)
1961	14.3/+3.4 ^{a)} 37/—21 ^{b)}	14.6/—1.5 69/—8	20.2/+0.9 104/+30	19.5/—1.8 74/+2	20.5/+0.2 31/—52	18.6/+2.4 10/—60	17.9/+0.6 54.1/—1.8
1962	11.6/+0.7 33/—25	14.1/—2 53/—24	17.1/—22 32/—42	19/—2.3 107/+35	21.5/+1.2 15/—68	15/—1.2 42/—28	16.3/—0.9 47/—25
1963	12.1/+1.2 37/—21	15.9/—0.2 26/—51	20.3/+1 89/+15	22.4/+1.1 13/—59	20.7/+0.4 14.3/+60	17.1/+0.9 82/+12	18/+0.7 65/—7.3

- Notes: 1) Data taken from M. KÉRI (National Meteorological Institute, Budapest): *Nemesített növényfajtákkal végzett országos fajtakísérletek eredményei* (The Results of Performance Trials of Improved Plant Varieties in Hungary). (Budapest, 1961, 1962, 1963.)
- a) The nominator contains the monthly mean temperature in C°, the denominator the deviation from the 40-year average (in C°).
- b) The numerator contains the monthly precipitation in mm., while the denominator contains the deviation from the mean, in mm.

There was ample rain in the middle of April, 1960: in May and June the temperature did not rise above the average recorded in many years. In June 2—3 °C less than average were measured and the precipitation of this month was favourable for setting. Therefore, the average yield of 1960 was relatively high. In 1961, however, with the exception of April and September, the average temperature was 0.6 °C higher, while precipitation was 1.8 mm less. In 1962 temperature was 0.9 °C lower and precipitation 1.8 mm less: in 1963 the temperature was 0.7 °C higher and precipitation 7.3 mm less than the average of the last forty years (Table 4). These climatic changes adversely affected the potato yields, reduced resistance to virus infections or, in case of potatoes, tolerance to viruses.

c) *Bionomics of aphids*

During the 1962 examination of aphids as virus vectors (BORUS et al. 1965) it became clear that the aphids had first appeared on May 28th and by June 11th there had been a considerable number of them. Significantly, they were first noted on the Gülbaba variety (May 28) and on June 11th aphids were counted on the 100-unit plot: Gülbaba: 1950, Somogyi Korai: 1305 and Kisvárdai Rózsa: 58.²⁾

Varieties that had been highly infected proved to have the largest aphid populations. According to data collected on July 11th: Gülbaba: 125.061, Kisvárdai Rózsa: 17.048 and Somogyi Kifli: 29.900, while the other varieties were much less infested: Somogyi Korai: 2.228, Mindenés: 2.200 and Somogyi Sárga: 30. The aphid population was the highest for these varieties on July 18: Somogyi Korai: 9.660, Mindenés: 19,880 and Somogyi Sárga: 120. But these values are still much lower than the maximum figures for the Gülbaba, Kisvárdai Rózsa, and Somogyi Kifli varieties. The first nymphs appeared at the end of June and the winged insects in the middle of July. The mature insects comprised 30—71 % of the population. The population included *Aphis nasturtii* Kalt. (95%), *Myzus persicae* Sulz. (0.9%) and *Aphis gossypii* Glov. (0.1%). Large-scale infestation began in the middle of June when the *Myzus persicae* Sulz. appeared. Swarming reached its peak around the 10th of July (cit. BORUS et al. 1965).

²⁾ Recent experiments with *Toxoptera citridus* Kirk. (SCHWARZ 1965) have proved that in certain periods these aphids are ten times more attracted to a yellow surface (yellow platess) than to green ones, while in other periods there is no preference shown. It is therefore feasible that other kinds of aphids as, for instance, *Myzus persicae* Sulz. may also be attracted by yellow in certain seasons. MÜNSTER's examinations (1958) proved that the yellow plate method, which is still commonly used, does not adequately indicate the invasion of aphids on potato fields. It is for this reason that the present article gives the pertinent results of the experiments on 100-unit plots as published by BORUS et al. (1965). More recently, however, for technical reasons the so-called hundred-leaf method is employed.

Table 5
Results of the content analysis of potato varieties

Variety	Date of test	Results of examinations				Sugar content (Invert sugar)	
		Water content		Dry-matter content			
		Gm1)	IGm2)	Gm1)	IGm2)	Gm1)	IGm2)
<i>Somogyi Kifli</i>	Aug. 28.	72.2 ^{a)}	73	27.8	27	0.27	0.66
		+1.8 ^{b)}	—1	—1.8	+1	+0.39	—
<i>Gülbaba</i>	Aug. 28.	76.2	77.8	23.8	22.2	0.35	0.64
		+1.8	—0.2	—1.8	+0.2	+0.46	—0.17
<i>Kisvárdai Rózsa</i>	Sep. 29.	77	74	23	26	0.34	0.50
		—3.8	+0.8	+3.8	—0.8	+0.25	—0.09
<i>Mindenés</i>	Sep. 29.	82.6	70.2	17.4	29.8	0.76	1.14
		—8.6	—3.8	+8	+3.8	—0.02	+0.40
<i>Somogyi Korai</i>	Aug. 28.	74.6	77.6	25.4	22.4	0.45	0.24
		+0.8	+2.2	—0.8	—2.2	+0.14	—0.35
<i>Somogyi Sárga</i>	Sep. 29.	74.8	74.2	25.2	25.8	0.89	0.99
		+3.6	—4.2	—3.6	+4.2	—0.16	+0.26

Notes: 1) German method, 2) Improved German method
^{a)} Results of the 1962 examination.
^{b)} Deviation from the 1961 figures.

d) Content analysis of potato varieties

The water, dry-matter and sugar contents of the different varieties were determined by the method described in my first publication. These tests were performed after the complete ripening of the varieties, thus after 124 or 155 days of growing in case of the early or the medium-late varieties respectively. The water content of *Somogyi Kifli*, *Gülbaba*, *Somogyi Korai* and *Somogyi Sárga* was reduced while the dry-matter content increased. The situation was just the reverse for the *Kisvárdai Rózsa* and *Mindenés* varieties (in comparison to the earlier figures). According to the 1961 data the sugar content of *Mindenés* and *Somogyi Sárga* decreased while that of the *Somogyi Kifli*, *Gülbaba*, *Kisvárdai Rózsa* and *Somogyi Korai* increased (Table 5).

2. Improved German method

a) Virus infection

Virus experiments in the field based on the improved German method were carried out between May 15 and 20 and June 1 and 4, while selection was made between May 5 and 9, 21 and 25 and between June 4 and 10. The results show that viruses are reducible with the exception of the PVS infection of *Somogyi Kifli* (in comparison to the data obtained in 1961). How-

Table 6
Average virus infection of potatoes during the examination of the improved German method

(Including complex virus forms, healthy plants and index of infection)

Variety	No. of selected plants in %	Occurrence of viruses in 1963, in %				No. of healthy plants	Complex virus forms	Index of infection
		PVX	PVY	PVS	PLRV			
<i>Somogyi Kifli</i>	26 ^{a)} /37 ^{b)}	4 ^{c)} /15 ^{d)}	7/33.5	36/32.5	10/25	46/33	6/59.5	57/106
		—73.4 ^{e)}	—79.2	+10.7	—60	+39.3	—90	—46.3
<i>Gülbaba</i>	43/51	20/22	8/12.5	61/69.5	18/39	22/9	24/43	107/143
		—9.1	—36	—12.3	—53.9	+150	—44.2	—25.2
<i>Kisvárdai Rózsa</i>	63/77	10/13.5	10/9	39/39	23/57	28/12	25/32	82/118.5
		—26	+11	0	—59.7	+133	—21.9	—30.9
<i>Mindenes</i>	26/35	2/8	1/5	35/59	3/23	75/32	2/29	41/95
		—75	—80	—40.7	—87.0	+134.3	—93.2	—56.9
<i>Somogyi Korai</i>	21/23	2/11.5	1/13.5	39/48.5	4/14	81/30	4/19.2	46/87.5
		—81.9	92.6	—19.6	—71.5	+170	—79.2	—47.5
<i>Somogyi Sárga</i>	27/45	4/10	6/11	33/35.5	8/31	63/35	7/17	51/87.5
		—60	45.5	—7.1	—74.2	+80	—58.9	—41.8

- Notes:
- a) the number of selected plants in 1962.
 - b) the number of selected plants in 1961.
 - c) Occurrence of viruses in 1963.
 - d) Occurrence of viruses in 1961.
 - e) Reduction of individual viruses, and complex virus forms, i.e., reduction of virus infection, in percentage (—) and the growth in the number of healthy plants in percentage (+).

Table 7

Yields of the different potato varieties in respect to standard grading of tubers (Improved German method)

Variety	Average yield per plant in decagrams 1962	Various grades of produced tubers (%) 1963 ⁽¹⁾ and the deviation from the data of 1961 ⁽²⁾										Quantity of yield in quintals per cadastral acre
		0—34 mm		35—79 mm		80—100 mm		101—120 mm		above 121 mm		
		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	
<i>Somogyi Kifli</i>	40 ^{a)} 30 ^{b)} +10 ^{c)}	14.2	+ 3.02	60.8	+ 2.13	18.1	+6.54	4.6	—6.10	2.3	+0.48	70.46/93.95 +23.49 ^{d)}
<i>Gülbaba</i>	28 25 + 3	9.2	—10.22	63.1	+ 0.31	17.9	+5.80	5.9	+2.40	3.8	+1.61	58.72/65.76 +7.04
<i>Kisvárdai Rózsa</i>	85 80 + 5	13.1	—15.6	70.5	+11.6	8.1	—1.7	4.8	+2.6	3.5	+3.1	187.90/199.64 +11.74
		0—39 mm		40—60 mm		61—80 mm		above 81 mm				
<i>Mindenes</i>	110 88 +22	25.3	—15.76	60.1	+ 9.09	12.5	+ 4.84	2.1	+1.86	.....		206.88/258.36 +51.48
<i>Somogyi Korai</i>	85 60 +25	17.4	—25.86	59.6	+16.16	19.8	+7.08	3.2	+2.62	.....		140.92/199.64 +58.72
<i>Somogyi Sárga</i>	115 83 +32	16.7	—12.8	57.9	+ 2.1	21.8	+7.7	3.6	+3.0	.....		194.95/270.11 +75.16

Note:

^{a)} — average yield per plant in decagrams (1962).^{b)} — average yield per plant in decagrams (1961).^{c)} — deviation in the average yield per plant (in decagrams) in comparison to the 1961 data.^{d)} — deviation in the quantity of the yield (in quintals per cadastral acre) in comparison to the 1961 data.

ever, these values cannot be accepted even on the basis of the extremely thorough selection done over a two-year period (39.4%) (Table 6).

Somogyi Korai showed the greatest reduction of PVX (81.9%), but for *Gülbaba* there was only a 9.1% reduction (Table 6). We could hardly reduce the spread of PVY in 1963 after two years of thorough selection. Moreover, this virus increased by 11% for *Kisvárdai Rózsa*. In contrast to these *Somogyi Korai*, *Somogyi Kifli* and *Mindenes* showed a 92.6%, 79.2% and 80% reduction respectively (Table 6).

Instead of being reduced, PVS increased by 10.7% in the *Somogyi Kifli* variety. I have succeeded in reducing slightly the occurrence of PVS in the other varieties: *Gülbaba*: 12.3%; *Mindenes*: 40.7%; *Somogyi Korai*: 19.6% and *Somogyi Sárga*: 7.1% (Table 6).

PLRV was reduced by 87% for *Mindenes* while for *Gülbaba* and *Kisvárdai Rózsa* the reduction was only 53.9% and 59.7% respectively (Table 6).

I was happy to note that the number of healthy *Somogyi Korai* plants had increased by 170% and increases had been found among the other varieties, too. The complex virus forms were especially reduced for the *Somogyi Kifli* and *Somogyi Korai* and there was no increase for any of the varieties (Table 6).

Virus infection was in general reduced from 25.2 to 56.9%.

b) Yields

It is significant that experiments based on the improved German method showed a 3–32 decagram yield increase per plant in comparison to the yields of 1961. Forcing had presumably a favourable effect on yield because the average yield of the varieties produced with the German method (without forcing) was 2–26 decagrams less per plant in comparison to the 1962 average yields. The yield per cadastral acre increased to the same extent (Table 7).

c) Content analysis of the potatoes

After the full ripening of the different varieties, content analyses were performed. In comparison to the figures of 1961 the water content of a few potato varieties was reduced, while the dry-matter content increased (*Somogyi Kifli*: ± 1 ; *Gülbaba*: ± 0.2 ; *Kisvárdai Rózsa*: ± 0.8 ; *Mindenes*: ± 3.8 ; *Somogyi Korai*: ± 2.2 and *Somogyi Sárga*: ± 4.2).

In comparison to the data gained in 1961 the sugar content of *Gülbaba*, *Kisvárdai Rózsa*, *Somogyi Korai* was reduced, while that of *Mindenes* and *Somogyi Sárga* increased and *Somogyi Kifli* remained the same (Table 5).

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RECLAMATION OF THE SANDY SOILS OF TAHREER PROVINCE USING DEEP SHEET LAYERS

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39 lyzimeter plots were filled with sandy soil from Tahreer Province, Deep sheet layers used were clay, farm manure at depths 50, 60, 70 cm, and isolating substances at 60 cm depth. Barley, and peanuts were planted in these lyzimeters. The effects of this treatment on percolated water and crop yield were investigated. The results obtained showed clearly that using any of the deep sheet layer was better than control or surface manured treatments. Also that isolating layers were best for the purpose aimed at, followed by farm manure treatments, then the clay treatments. The result of the present work was discussed and compared to results of other authors, which gave backing to the results achieved.

Introduction

The whole area of U.A.R. is about 250 million feddan. Out of the 8 millions arable feddan, only 6 millions are cultivated. In other words, the cultivated land in U.A.R. is limited to the Delta besides a green ribbon of limited width on both sides of the Nile surrounded by desert. The desert soils belong to the arid zone under which warm conditions and lack of water prevail. Weathering factors especially the chemical ones are weak owing to absence of the water factor. Humus formation is rare owing to its quick decomposition under high temperature. Continual sinking of clay with downward movement of irrigation water represents a weak point in sand amelioration. The problem of utilizing and improving loose sandy soils has not been completely clarified. In spite of the accumulated literature and correct inferences suggested by many scientists, the development of the agrotechnics of sandy soils (except in the Netherlands) is in general far from satisfactory. This work is aimed to apply and attract the attention to the new method used by EGERSZEGI (1953) in Hungary. Its success resulted in its application in Soviet Union, Italy, Poland, Czechoslovakia, East Germany, and Holland. This method is by the present authors believed to be the cheapest proper method to be practiced in U.A.R.

Besides the usual method of sand cultivation such as surface agriculture practice in which depth of ploughing determines volume root development, stabilization of sand surface, inundation by silt-charged water and enrichment with clay, the above method of sand reclamation which ensures a higher degree

of utilizing water and nutrient content, and provides more profitable use of organic matter should be adopted.

EGERSZEGI (1953) states that spreading a carpet-like layer of clay and different organic substances in a depth of 40 cm reduces the velocity of water percolating downwards. Also that way more water can be stored at a depth beyond the ploughed layer. The substance to be used in building the layer must have a higher water-holding capacity, high moisture content in state of equilibrium, good water releasing ability, and a retaining effect on percolation without being quite water tight. In addition the improving layer is a source of nutrients. He adds that sand improvement, by carpet like placed layers realizes the principle of combining a larger potential water stock with an abundant and active local source of nutrients. The presence of mineral colloids favourably influences the adsorption of both water and nutrients.

From the above, it seemed important to apply and study this method in the U.A.R. especially after its success by EGERSZEGI (1953), ANTAL (1956), LÁNG (1958), KLIMES (1956) and MAKLED (1962).

Experimental Part

a) *Design of experiments*

Experiments were carried out in lyzimeters containing sandy soil of Tahreer Province Southern part. Virgin sand was put in the lyzimeter's plots. Each plot size was 1 m³, filtrated water was collected from lyzimeters to be analysed. The deep sheet layers used in these experiments were either of clay taken from Nile sediments (57% silt + clay, 0.075% total N), farm manure (40% silt + clay, 0.90% total N), or either one of the isolating layers described below. Crops used in the experiments were barley and peanuts.

The treatments were as follows:

A) Clay and farm manure experiments:

Either clay or manure was put at depths recorded.

1. Control without any addition.
2. Surface clay addition.
3. One layer at 50 cm depth.
4. One layer at 60 cm depth.
5. One layer at 70 cm depth.

B) Isolating substances

1. Control without any addition.
2. Perforated asphalt layer at 60 cm depth.
3. Perforated white nylon layer at 60 cm depth.
4. Perforated black nylon layer at 60 cm depth.
5. Asphalted perforated canvas at 60 cm depth.
6. Asphalted perforated parchment paper at 60 cm depth.

Three replicates for each treatment were planed and tested. For minimising the amount of the irrigation water 525 litre water was given to every treatment all over the vegetation period. Percolated water was gathered and analyzed.

b) *Analytical methods*

Mechanical analysis was determined by decantation method, calcium carbonate by Collind calcimeter. Water extract used in chemical analysis was 1 : 1 organic matter was estimated by WALKELY-BLACKS, total nitrogen with Kjeldahl method.

Results

Tables 1, 2 show the mechanical, and chemical analysis of sand used. From these tables it is clear that the used sand is very poor in organic matter and nitrogen.

Table 1

Mechanical analysis of the used sand in per cent

Gravel	Coarse sand	Fine sand	Silt+clay	CaCO ₃	T. S. S.
—	72.17	25.75	1.44	0.62	0.02

Table 2

Chemical analysis of the used sand

Total soluble salts	0.02%
Sodium carbonate	—
Sodium bicarbonate	0.12 m.e.
Sodium chloride	0.17 m.e.
pH	8.1
Organic matter	0.01%
Total nitrogen	0.002%
C/N	3

Barley was sown on the 7th of November 1962 using same quantity of grains to every treatment. Table 3 presents the effect of placed layer on the quantity of percolated water and its N content.

From the above table it is clear that:

1. The highest amount of percolated water was gathered from the control.
2. Placing a layer at different depths decreased the infiltrated water in comparison also to surface fertilization.
3. Total nitrogen in the percolated water was less in treatments made with sheet layers meaning that more nitrogen was used by the plant roots or restored in the soil for the benefit of the roots.
4. Isolating substances have the highest efficiency to retard the infiltrating water and prevent nutrients from loss.

On the 10th of April 1963 crop was gathered. Seeds were separated from straw, and weighed. Weights can be seen on table 4.

Table 3
Percolated water and its N content

Number	Treatments	Water quantity	Percolated water litre	Soluble N in percolated water p.p.m.
1	Control	525	155	240
2	Clay on surface	525	121	230
3	Clay at 50 cm depth	525	107	160
4	Clay at 60 cm depth	525	100	140
5	Clay at 70 cm depth	525	98	140
6	Farm manure at 50 cm depth	525	97	130
7	Farm manure at 60 cm depth	525	95	130
8	Farm manure at 70 cm depth	525	93	120
9	Asphalt at 60 cm depth	525	78	120
10	White nylon at 60 cm depth	525	92	120
11	Black nylon at 60 cm depth	525	92	120
12	Asphalted canvas at 60 cm depth	525	91	150
13	Asphalted parchment paper 60 cm depth	525	91	150

Table 4
Effect of the different treatments on crop yields of Barley

Number	Treatments	Seeds in K/per feddan	Yield increase calculated as percentages of control
1	Control	75	100.0
2	Clay (on surface)	200	266.6
3	Clay at 50 cm depth	265	353.3
4	Clay at 60 cm depth	265	353.3
5	Clay at 70 cm depth	260	346.6
6	Farm manure at 50 cm depth	280	373.3
7	Farm manure at 60 cm depth	280	373.3
8	Farm manure at 70 cm depth	260	346.6
9	Asphalt at 60 cm depth	320	426.6
10	White nylon 60 cm depth	310	413.3
11	Black nylon 60 cm depth	310	413.3
12	Asphalted canvas 60 cm depth	270	360.0
13	Asphalted parchment paper 60 cm depth	260	346.6
L. S. D.		60.8	

Table 5
Analysis of variances

Source of variances	Degree of freedom	Sum squares	Mean. S. S.	F. from tables	F. from data
1. Treatments	12	8714	726	2.18	8.9
2. Replicates	2	381	191	3.40	2.4
3. Error	24	1949	81		

From this table and statistical analysis of data it can be concluded that:

1. Treating the sand with different layers gave more significant crop yield increase than the control.

2. With regard to different depths of all treatments there were no significant differences between them.

3. The single treatment which gave significant differences was the asphalt in comparison to clay layer placed at 70 cm and asphalted parchment paper at 60 cm.

4. The decreasing effect of the placed layers was isolating materials > farm manure > clay.

The experiments were continued only by planting peanut seeds on 23rd of May 1963 with the same treatments, replicates plots, without any addition

Table 6
Effect of the different treatments on crop yield of peanuts

Number	Treatments	Seeds in Kilogram/per feddan	Yield increase Calculated percentage Control
1	Control	1400	100.0
2	Clay (on surface)	1600	114.2
3	Clay at 50 cm depth	1800	128.5
4	Clay at 60 cm depth	1800	128.5
5	Clay at 70 cm depth	1750	125.0
6	Farm manure at 50 cm depth	2000	142.8
7	Farm manure at 60 cm depth	2000	142.8
8	Farm manure at 70 cm depth	1900	135.7
9	Asphalt at 60 cm depth	2200	157.1
10	White nylon at 60 cm depth	2100	150.0
11	Black nylon at 60 cm depth	2100	150.0
12	Asphalted canvas at 60 cm depth	2000	142.8
13	Asphalted parchment paper at 60 cm depth	1900	135.7
	L. S. D.	136	

Table 7
Analysis of variances

Source of variances	Degree of freedom	Sum squares	Mean. S. S.	F. from tables	F. from data
Between					
1. Treatments	12	96 764	8.064	2.18	19.5
Between					
2. Replicates	2	62	31	3.40	0.08
3. Error	24	9 903	413		

of clay or manure and were gathered on 8th of October 1963 as shown in Table 6.

Tables 6 and 7 gave the same conclusions as Tables 4 and 5. Moreover, it is most important to point out concerning the crop yield that there were significant differences between treatments of isolating substances, farm manure, and clay treatments.

To have an accurate decision about applying this method in large scale, barley was recultivated in the same lyzimeters. It was sown on the 7th of November 1963 under the same conditions. Table 8 presents the grain weight measured on 8th of April 1964.

Table 8
Effect of the different treatments on crop yield of barley

Number	Treatments	Seeds in Kilo/per feddan	Yield increase as percentage of control
1	Control	80	100.0
2	Clay (on surface)	330	
3	Clay at 50 cm depth	400	
4	Clay at 60 cm depth	390	
5	Clay at 70 cm depth	360	
6	Farm manure at 50 cm depth	410	
7	Farm manure at 60 cm depth	360	
8	Farm manure at 70 cm depth	370	
9	Asphalt at 60	400	
10	White nylon at 60 cm depth	380	
11	Black nylon at 60 cm depth	380	
12	Asphalted canvas at 60 cm depth	360	
13	Asphalted parchment paper at 60 cm depth	350	
	L. S. D.	122	

Results obtained in Tables 8 and 9 confirmed results and conclusions of the first experiment in 1962.

Table 9
Analysis of variances

Source of variances	Degree of freedom	Sum squares	Mean. S. S.	F. from tables	F. from data
1. Between treatments	12	267 857	20 604	2.18	3.8
2. Between replicates	2	15 471	7 735	3.37	1.4
3. Error	24	138 529	5 328		

Discussion

Sandy soil improvement by deep sheet layers were used by many scientists and proved to be one of the best methods. The present work was performed in the United Arab Republic in the Tahreer Province to assure its efficiency as a modern cheap method against sand amelioration under local conditions.

The results obtained in this work are in agreement with those achieved by EGRSZEGI (1953), KLIMES (1956) and LÁNG (1958). KLIMES reported that the deep sheet layers were responsible for:

1. Water accumulated in the profile being about 20% more than in the non-reclaimed sand.
2. Increasing the original field capacity owing to the decrease of water conductivity.
3. Higher moisture content than the surrounding sand which must be attributed to the absorption force of the layer.
4. Their green mass containing more moisture at the same time than the surface manuring or unreclaimed.
5. The powerful development of roots due to loosening the deep layers.

Similar results were also reported by LÁNG (1958). The following table shows his results:

Treatments	Yield Q/Kh	
	Seeds	Straw
1. Untreated sand	1.87	5.62
2. Surface farm manured sand	6.40	14.43
3. Sand reclaimed with one layer of farmyard manure	16.06	32.17
Q = 100 kilogram		
Kh = 5755 m ²		

It was also reported by Láng that the sand reclaimed by this method increased the total yield compared with the mean yields of the same farm as

	increase in yield
Feed crops	53%
Cereals	22%
Potatoes	70%

These results in addition to what this work has shown, makes it easy to conclude that this new method is by far, the best. The treatments used resulted in retarding the velocity of infiltrating water downwards, restoring more nutrients. Isolating substances gave the highest crop yield with regard to farm manure and clay treatments. Farm manure treatments gave somewhat higher crop yield increase than those of clay treatments. There were no significant differences between the different depths of placed layers, which ensured that there was no need to put the layer deeper than 50 cm to decrease the expenses.

In addition to higher yields attained, cost of reclamation is not expensive. On the contrary it may be considered cheaper than other standard methods when keeping in mind the time factor, its residual effect, and that it is applied once to the same soil. Practical cost should therefore be estimated by using this method on large scale, using mechanical instruments. The author emphasizes the importance of running such an experiment in the near future.

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THE CHANGES OF SOLASODINE CONTENT IN THE “INDUSTRIAL SHOOTS” OF *SOLANUM LACINIATUM* AIT.

By

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We have studied, according to the parts of the day, the changes of solasodine content in the shoot tips of *Solanum laciniatum* Ait. to be worked up industrially. It has been found that the concentration of solasodine in the shoot tips decreases at day-time while at night and at dawn respectively, it becomes greater.

Introduction

It is a well-known phenomenon that the agent of medicinal plants undergoes considerable changes in the course of the ontogenetic development of the plant. That fact had been established by MURAVJEVA et al. (1964) also with the plant examined here. In favour of ensuring higher agent content according to the V. Hungarian Pharmacopoeia, too, (1954) the leaf drugs of *Solanaceae* must be gathered during flowering or at the beginning of flowering, while the stem-leaves of *Digitalis purpurea* L. before flowering. However, one cannot state in such an unanimous manner that in the accumulation of the so-called secondary metabolism products there exists with every plant a daily rhythm, too.

The knowledge of the change in agents according to the parts of the day is very important especially if the medicinal plant is used as raw material for medicines. Through knowing the proper time of gathering, more agent can be obtained and this might reduce the processing expenses considerably. That is the reason why we aimed at examining the change of the solasodine content taken as a function of part of the day in the *Solanum laciniatum* Ait. shoots meant to be used for industrial purposes. We have been confirmed in our aim also by the fact that MÁTHÉ—FÖLDESI (1965) in their most up-to-date monography have not mentioned yet the daily change of glycoalkaloids.

Though the examination of the daily fluctuation of alkaloids and glycosides as two important groups of agents, has not produced so far uniform results, HEMBERG—FLÜCK (1953) have found in the *Datura stramonium* L., and HEYDENREICH—PFEIFER (1962) in the *Papaver somniferum* L. that the quantity of alkaloids increases during the night reaching its maximum in the early morning hours, while it drops at day-time. SÁRKÁNY—DÁNOS (1957)

having examined the rhythm of morphine and the associate alkaloids in the poppy, during the development of the capsule and seed in 3 cycles, have noticed in the developing capsules besides the maximum of the forenoon hours, another maximum in the night- and the early morning hours. In some of the glycoside containing plants the daily oscillation of the glycoside quantity has not been established, while in case of other glycoside containing plants this could be done. Thus, according to HEGNAUER (1953) in the leaves of *Arctostaphylos uva ursi* (L.) Spreng. the arbutine, in those of *Saponaria officinalis* L. the saponine and the glycosides of *Rheum palmatum* L. are present in small quantities in the morning while their quantity is higher at noon or in the evening. According to the investigation of HEGNAUER (1953), the steroid glycosides being of importance in the present case, are to be found in the leaves of *Digitalis purpurea* L. in a higher amount during afternoon showing a maximum at 5 p.m. That result is in good agreement with the results of other investigations and show that the accumulation and formation, respectively, of the glycosides are in connection with insolation.

The change of glycoalkaloids in plants especially in the *Solanum* species has not been dealt with or only very little. Here we can refer only to the publication of BALCAR-SKRZYDLEWSKA et al. (1964) who examined the daily fluctuation of the glycoalkaloid content in the leaves of *Solanum laciniatum* Ait. in samples taken every 4 hour throughout 3 days. They came to the conclusion that the regular daily oscillations of the glycoalkaloid content could not be established in a habitually repeated way.

Material and Method

Our aim was to examine the change occurring in the different parts of the day, in the solasodine content of the so-called "industrial shoots" (25–40 cm shoot-tips) that hadn't yet been examined so far. (Fig. 1.) The need for examining the shoots has appeared in the fact that the gathering of the leaves demands much work and thus not economical for industrial processing; furthermore, according to recent statements, the formation of glycoalkaloids in the *Solanum laciniatum* as contrasted with other *Solanaceae* plants occurs in the leaves and perhaps in the young stems rather than in the root (VÁGÚJFALVI 1965).

The samples for our investigations were gathered in the Budakalász fields of the Gyógynövény Kutató Intézet (Research Inst. for Medicinal Plants) twice 24 hours on the 5–6 Oct. 1965, and 12–13 Oct. 1965. Gathering started at 8 a.m. and every second hour the 25 cm shoot-tips were cut from 50–50 different plants. The shoot-tips being cut to pieces of 5 mm were desenzymated at 105°C to 15' and then dried up at room temperature. The air-dried drug was dried at 60° C to weight constancy and then powdered (0–0.75 mm). The drug powder was homogenized, weighed and kept in exsiccator until the determination of solasodine content. The percentage of dry substance referred to the fresh weight, was calculated from the ratio of fresh-weight and dry-weight.

The plants of about the same developmental stage from which samples were gathered were one year old, approximately 140 cm high, rather branching plants with ligneous stem and having fruit being turn into yellow, however, still in flower. The plants produced for about ten years in Hungary, furnished the seed-material for growing in 1966, and might be considered genetically uniform. The growing of the plants was performed in a Danube flood area rich in nutrients and being about 1 cadastral yoke.

Since the collecting of the material from one plant or from the same group of plants would not be advisable because of the high-degree damage done to the plant and, due to it, to the considerable change of their metabolism, we decided to gather the material always from different 50 plants in a way that before starting gathering, 600—600 individuals of similar development — on the basis of field estimation — had been assigned. First of all, we wanted to follow with attention the formation of the drug agent meant for industrial processing and to establish whether the type of the daily rhythm in glycoalkaloids was glyco-



Fig. 1. Shoot tips cut for industrial processing (Photo: J. Biró)

sidic or similar to the *Solanaceae* alkaloids, was but an item of secondary importance. We are of the opinion that the samples taken from a great number of plants will give average results that can be evaluated.

Simultaneously with the sampling done every 2 hours, we measured also the temperature. The temperature values as well as the day- and night hours are shown on Fig. 2. The temperature during the first series gathering was relatively high, but towards the end of the second series gathering, in the early morning hours, it dropped back to 0° C.

The solasodine content of the samples has been measured with the method of Mrs. VALOVICS (1964), which consists of extracting the drug powder with 2% oxalic acid and hydrolysing the glycoalkaloids — in the aliquot of the extraction — with hydrochloric acid on waterbath. After finishing the hydrolysis, the solasodine basis was precipitated with alkali. From the precipitate the solasodine was carried into chloroform and the basis titrated, in a medium free from water, with a chloroform p-toluol sulfonic acid measuring liquid (titrating solution).

The percentile solasodine values shown in Figures 2 and 3 are the results of the average values of 3—3 measurings agreeing within $\pm 2.4\%$.

Results and Discussion

In Fig. 2 the solasodine per cent as calculated for the fresh weight, the hours in day and night and temperature values are shown. The percentile solasodine content referred to the raw material, — though the curve is showing

some fluctuation, — seems to be higher at dawn, then it decreases at day-time, and at night it is higher than during the day. The solasodine content does not show closer relation with temperature though in case of higher temperature values, the solasodine content referred to the fresh weight, is relatively low (Fig. 2).

In Fig. 3 the percentile solasodine values referring to the dry material, and the percentile formation of the dry material content in the samples are shown. The solasodine curve is similar to the previous one. With the beginning

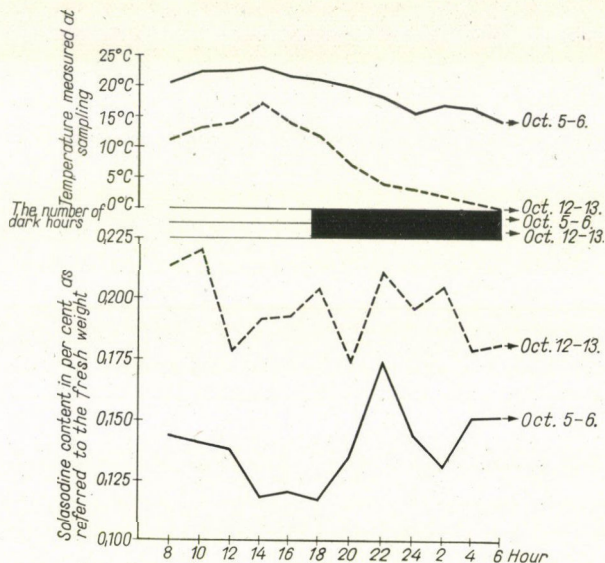


Fig. 2. The formation of solasodine content in per cent as referred to the fresh weight

of photosynthesis and assimilation the dry material content increases reaching its maximum at 4 p.m. and afterwards it decreases. Simultaneously with the maximum of dry material content the solasodine minimum as referred to the dry material content was observed. This proves certain relationship between the two processes in spite of the fact that during the night-hours that relationship is far from being so unambiguous (Fig. 3).

Our results considerably differ from those obtained by BALCAR-SKRZYDLEWSKA et al. (1964) who registered a general increase of glycoalkaloid content at day-time while a general decrease at night. Neither agrees with our results their statement according to which the maximum of the glycoalkaloids coincides, with the maximum dry material content in three cases. It is to be mentioned, however, that the authors have examined only the leaves and not the so-called "industrial shoots"; furthermore, even in their opinion their method to determine the glycoalkaloids was less accurate. On the basis of their results they concluded that with *Solanum laciniatum* continuously

repeated regular fluctuations did not occur in glycoalkaloid content corresponding to the rhythmic change of day and night.

Our results show that there exists a certain daily rhythm in the change of solasodine content also proved by the percentile values as calculated for the fresh weight. Since this rhythm shows a certain relationship with the changes of the dry material content as well this might be a consequence of it and therefore it could be decided for certain only after further investigations — may be on the basis of measurements made during the period of repeated cuts

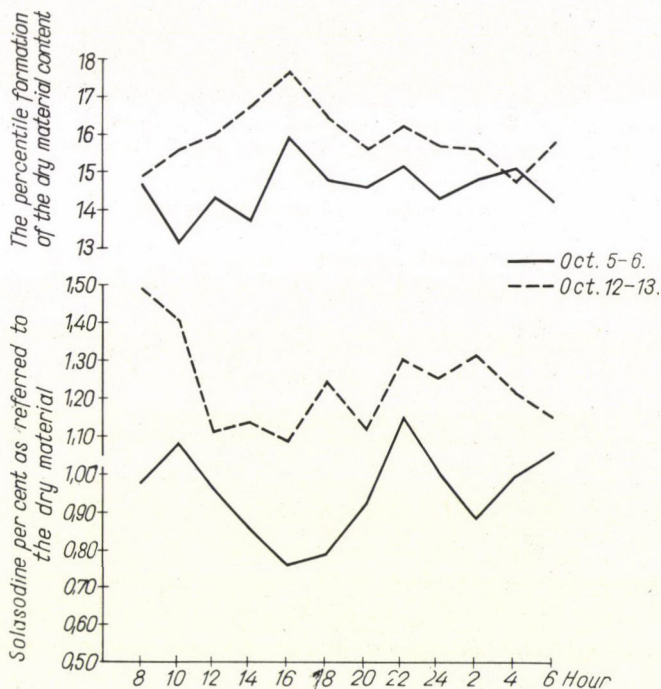


Fig. 3. The formation of the percentile solasodine content as referred to the dry material content

in shoots being usual in practice — whether the change was a regular consequence of the metabolic processes.

The course of the daily change in solasodine content is not similar to the curve showing the daily change in the steroid cardiac glycosids (HEGNAUER 1953); it rather corresponds with the daily rhythm of the *Datura*-alkaloids as described by HEMBERG—FLÜCK (1953). On the basis of the above, it is supposed that the daily change of glycoalkaloids taking place in their structure between the glycosides and alkaloids is, according to the plant family, of *Solanaceae* type, and no glycosidic factors are characteristic in it.

Conclusions

In order to secure drugs of higher solasodine content for the drug-industry, we suggest — on the basis of our experiments, — to limit the time of gathering to the morning- and early forenoon hours not later than until 10—11 o'clock a.m. Gathering in the afternoon seems not to be advisable.

Acknowledgement

We want to express our thanks to the Director of the Gyógynövény Kutató Intézet (Research Institute for Medicinal Plants) for placing at our disposal the plant material needed in our investigations and for his manifold assistance.

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THE INFLUENCE OF PLANTING SHELLED AND UNSHELLED SEEDS ON SEEDLING EMERGENCE OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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A field experiment was conducted on the 23rd of August, 1964 to study the influence of planting shelled and unshelled seeds on seedling emergence of two varieties (Ashford and Rubatab) of groundnut (*Arachis hypogaea* L.). The results indicated that planting unshelled seed is unfavourable as it delays emergence and reduces the stand as well. Further, basal seeds usually germinate later than apical seeds due to dormancy effect. However they have greater oil percentage than apical seeds.

Introduction

Poor stand establishment of groundnut seedlings in the field is detrimental to the final yield. Results of several investigations indicated that seed bed losses may occur as a result of either planting mechanically injured or diseased seeds. Deeper plantings at variable soil temperatures and the use of different seed sizes at planting can also lead to serious losses (GIBSON—CLINTON 1953, TOMS 1963). Further, planting unshelled seed delays germination and emergence of the seedlings above the soil surface (ORAM 1958, SHANKER—SRINIVASALU 1956); thus preventing an early stand establishment which is partly responsible for increase in yields. However, there is little information on how planting unshelled seeds reduces the final stand and what is the significance of the basal seed within the shell on emerging seedlings (TOOLE—BAILEY—TOOLE 1964). With these views in mind the following study was undertaken.

Materials and Methods

A field experiment was conducted using shelled and unshelled seeds of Ashford and Rubatab varieties. This gave in effect four treatments which were planted on the 23rd of August, 1964 in plots measuring 6×7 meters each. Each plot consisted of 8 rows, between row spacing being 70 cm. The seeds were then sown by hand at the rate of two seeds per hole — in case of shelled seed — and one pod per hole — in case of unshelled seed —, the holes being 20 cm apart. For unshelled planting two seeded pods were selected for both varieties.

The four treatments were replicated three times in completely randomized blocks. Emergence above the soil surface was then recorded at intervals between 8 and 22 days from planting. Plants were considered to have emerged when they had two unfolded leaves.

For further analysis to reveal some of the differences between the two seeds in one pod, 100 pods were chosen at random for each variety. They were then shelled and each apical and basal seed was weighed separately and germinated in a petri dish. Oil content of each group of apical and basal seeds was determined using the ether extract method.

Results and Discussion

Table 1 shows the treatment effect on the mean percentage emergence. The difference in emergence between the two varieties was too small to be of any practical significance. However, in each variety, unshelled seed delayed emergence considerably at all counting occasions, thus reaching 50% emergence 5 days later than the shelled seed. Further, it is of interest to note that while the stand established from shelled seed was 80% at 22 days from planting, it was only 48% for unshelled seed at the same time. This reduction was

Table 1
Treatment effect on mean percentage of emergence

Treatment	Days from planting				
	8	10	13	15	22
A—Ashford-Shelled	35.1	53.7	73.8	77.5	77.8
B—Ashford-Unshelled	4.2	21.9	44.0	47.2	47.5
C—Rubatab—Shelled	28.6	54.8	73.3	80.4	81.0
D—Rubatab—Unshelled	4.0	21.0	42.9	49.8	49.5
S. E. \pm	2.76	2.62	3.32	1.93	1.87

consistent and persistent during the growing season which suggests that planting unshelled seed does not only delay emergence but reduces the stand as well. Upon close examination, it was found that a small percentage (4.0%) of the loss in the stand was due to the presence of diseased and non-viable seeds within the pods. But in both varieties, the apical seed germinated earlier than

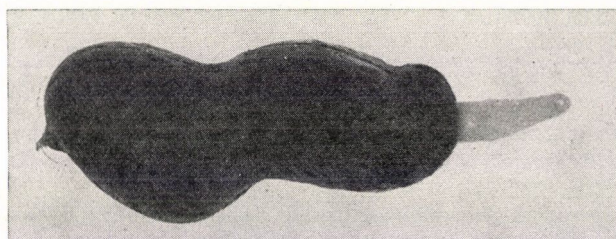


Fig. 1. Emergence of the radicle of the apical seed

the basal seed due to dormancy in the latter as indicated by TOOLE et al. (1964). However, the basal seeds germinated after approximately 48 hours possibly because of breaking the dormancy by prolonged soaking in water. But in general, the radicle of the apical seed emerged out of the pod first due to the split of the pod at the distal end (Fig. 1). Therefore the apical seed

emerged from the pod earlier than the basal one and in doing so pushed with it the other above the soil surface. This explained the observation that there were a number of seedlings scattered on the soil surface, thus leading to a loss of a considerable number of seedlings which in turn reduced the final stand. This perhaps explains why presoaking unshelled seed in water does not offset its disadvantage of late emergence as tried by YORK—WISER (1954).

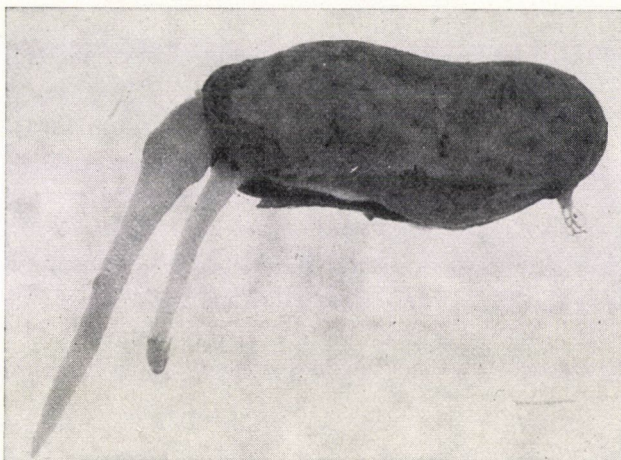


Fig. 2. Apical and basal radicles emerging

In addition, it was of great interest to investigate some of the differences, if any, between the apical and basal seed. Fig. 2 shows clearly that the radicle of the apical seed was longer and stronger than that of the basal seed. This may be due to the delayed germination of the basal seed and the exhaustion taking place when the radicle passed through a distance to emerge out of the apical fissure. Further, weighing individual seeds indicated that in Ashford about 69% of the basal seeds were greater in weight than the apical ones; while in Rubatab the percentage was 31% only. This shows that it is not always

Table 2

Mean oil percentage in apical and basal seeds

Treatment	Ashford		Rubatab		S. E. \pm
	Basal	Apical	Basal	Apical	
1—Basal seeds greater in wt. than apical seed	54.25	52.70	52.63	52.24	0.406
2—Apical seed greater in wt. than basal seed	53.84	51.98	51.80	50.63	0.374

true that the basal seed is greater in weight than the apical one because of its favourable position with regards the supply of nutritive materials. However, in both varieties and irrespective of the individual seed weight, the basal seed had always a greater oil percentage than the apical one (Table 2). But both types of seeds had a lower oil percentage in Rubatab than in Ashford. Further, when basal seeds were greater in weight than apical seeds, both seeds in both varieties showed an increase in oil percentage over both seeds when apical seeds were greater in weight than basal seeds. The fact that basal seed had always a greater oil percentage than the apical one is a new factor associating itself with the dormancy exhibited by that seed. However, since the causal factors are still controversial (TOOLE—BAILEY—TOOLE 1964) and since these results are only preliminary, further detailed investigations are necessary before a fast conclusion is drawn.

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VARIA

SZENTESI FEHÉR PAPRIKA

(*White paprika Szentesi*)



Systematical place: Capsicum annum L. var. grossum (L.) Willd. f. typicum My sf. erectum

My

Origin: From a local variety of Szentes by individual selection

Beginning of breeding: 1955, Szentes

Breeder: P. Szalva, Experiment Station of the Research Institute of Horticulture, Szentes.

State qualification: Preliminarily certified improved variety, 1963.

General characterization: Exportable non-hot dessert (table) paprika with largest berries in Hungary, white or pale green market ripening.

Morphological description:

Root system: after planting develops a vigorous accessory root system.

Shoot system: vigorous, attaining a height of 40-50 cm. Number of branch systems generally 3, archedly bending upwards. The relative main axis is stiff, of good standing ability and 11-12 cm long. Appearance of shoot system generally compact.

Foliage: of medium density. Leaf blade medium large and ovate. Colour light yellowish green.

Flowers: Corolla white, in cool weather the apex of the corolla lobes obtains a violet shade.

Fruit: erect, large, of elongated prism shape, at the apex infolded berry. Number of veins 3—4. In market ripeness the colour is bone white (obtains a greenish shade in cool weather), in full maturity lively red. Light mirroring, taste of agreeable aroma, spicy but non-hot. Pericarp 5—6 mm thick, fleshy, hard and elastic (excellently supporting transportation). Mean berry weight 55 g (ranging from 46.1 to 63.6; KOMJÁTI 1964).

Seed: flattened, reniform, 3—4 mm in diameter and of gold yellow colour. Every berry yields 80—120 seeds.

Biological characters:

Germination and seedling development: optimum temperature between 20—30° C.

Vegetation period: from sowing to planting of seedlings 7—8 weeks, from planting to flowering 30—45 days. Date of market ripening in the Szentes region on sandy loam June 25—28, on heavy meadow soil July 10—15 (SZALVA 1959).

Water requirement: considerable; demands a water supply corresponding to 650—700 mm precipitation ensured by the growers with supplementary irrigation. On poor soil or without irrigation the berries remain smaller and the fruit flesh thin.

Resistance to diseases: not unexceptionable but under favourable conditions escapes the diseases with its rapid development (SZALVA 1959).

Farm technology requirements: Seeding is carried out in the Szentes region with 10—13 g/sq.m. seeds in the second half of February in hotbeds. Plants must be covered with 3—5 cm thick compost. During the raising of seedlings it requires rare but abundant irrigation and before planting out “hardening” (for 1—2 weeks). In early cultivation planted out in the last decade of April. It is planted in a 33 × 33 cm spacing per plant so that the seedlings are placed into the soil up to the cotyledonary node. It is hoed 3 times and scuffled twice until the first irrigation. Every 10—14 days it is sufficiently irrigated by flooding the furrows between the ridges. Picking is regularly carried out every 4—5 days (SZALVA 1959).

Productivity: is only satisfactory under irrigated conditions, yields about 180—220 q/cad. hold. In the early picking period 26—36 per cent of total crop yield ripens to market quality. 70—75 per cent of the berries grown on the unit area is of excellent market quality.

Region of cultivation: Can be successfully grown in the southern parts of Hungary particularly in the Szentes region (KOMJÁTI 1965).

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FERTŐDI 293 ŐSZI BÚZA
(Winter wheat Fertődi 293)



Systematical place: *Triticum aestivum* L. var. *erythrospermum* (Körn.) MSF.

Origin: (Bánkúti 1201 × Kawvale) × Bánkúti 1201

Beginning of breeding: 1950, Fertőd

Breeder: F. Beke, Fertőd, Research Institute of Plant Breeding and Plant Production.

State qualification: State certified improved variety, 1957.

General characterization: Outstanding winter hardiness, tolerance to drought, standing ability, rapid development; productive, early, with red grains; a leaf rust resistant awned winter wheat of excellent flour quality.

Morphological description:

Root system: Its development is very similar to that of the *Bánkúti 1201* parent. The mass of roots is found in the 0–20 cm upper horizon of the soil (about 85 per cent of the roots) and penetrates into a depth of about 110 cm.

Shoot system: vigorously developed, medium tillering, of rapid development.

Culm: 104 cm on the average (range: 85–125 cm according to years), thin and more than medium stiff (lodging only in stormy weather or in case of heavy yields; PAPP 1965). Degree of lodging evaluated 4.2–4.7 (best = 5). According to many years' examinations it belongs to the Hungarian wheats of highest standing ability (PAPP 1960).

Foliage: consists in early age of medium erect, later of archedly bending leaves. Colour of leaves dark yellowish green, their surface hardly waxed. Leaf-blade lanceolate. Auricle green. Resistant to leaf (brown) rust.

Ear: Awned, slightly fusiform, 7.2 cm long on the average (amplitude: 6.9–7.6 cm). Colour of the ear in ripe condition light greyish yellow. In maturity erect, compact, well fertilized (generally 3–4 grains develop in every spikelet). Number of grains per ear 18.6 on the average (fluctuation per years 12.8–23.5). Number of ears per sq.m. is 460 on the average (ranging from 401 to 579). Awns subtend an acute angle and protrude longer than one third of the ear, their colour is light greyish yellow. The glume is somewhat elongated ovate, its plate medium bulg-

ing with slightly prominent spine. The apex of the glume is rounded off and drawn out into a pointed tooth. The inner part of the glume is pilose only in the apical part along the spine.

Caryopsis: elongated ovate, 6.7 mm long and 2.8 mm wide on the average (ranging from 5.8 to 7.6 mm in length and 2.4 to 3.1 mm in width). The apex of grain is rounded off and the tuft of pubescence extending to the ventral part. The embryo scutum is elliptic, the embryo vigorous and the part with the radicle moderately protruding. The grain is brownish red, its substance hard, flinty. Thousand grain weight 40.0 g on the average (ranging from 36.5 to 45.8 g) hectolitre weight 81.8 kg on the average (ranging from 77.2 to 84.7 kg). The grain is sometimes liable to shedding. The quality of the flour is good (B_1-A_2), wet aleuron content 34–38 per cent, dry aleuron content 11–12 per cent.

Biological characters:

Germination: cardinal points minimum $+2^\circ\text{C}$, optimum $+25^\circ\text{C}$, maximum $+35^\circ\text{C}$. Germination period in optimum 4.6 days (MÁNDY 1961).

Vegetation period: from seeding to earing on the average 221.2 days (ranging from 205 to 232 days), from seeding to waxen ripeness 261 days on the average (ranging from 249 to 271 days).

Development: rapid and vigorous, shooting and earing early. Maturation earlier than in *Bánkúti 1201*.

Winter hardiness: unexceptionable, winter killing at most 1.9 per cent (MESCH 1964).

Resistance to diseases: on account of its rapid development avoids stem rust; resistant to mildew, somewhat susceptible to loose smut. Resistance to leaf rust is its great merit.

Farm technology requirements: the favourable period of its seeding is between October 1–20 in Hungary. Seed requirement 3.1–3.3 million germs/cad. hold (540–560 germs/sq.m). (PAPP 1965) Demands a soil of good water regime and good cultural conditions, well provided with nutrients (PAPP 1965). Utilizes readily chemical fertilizer application of medium dosage rate.

Productivity: Many years' mean yield according to variety trials 19.7 q/cad. hold (ranging from 14.6 to 27.1 q/cad. hold) (MESCH 1964, PAPP 1965). Grain to straw ratio: 35 : 65 (PAPP 1963).

Area of cultivation: Can be successfully grown in all wheat growing regions of Hungary.

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CYTOLOGICAL OBSERVATIONS ON THE DIFFERENTIATING PROTODERM OF THE COTYLEDONS OF *ALLIUM CEPA* L.

The present study is concerned in the phenomena of cytoplasmic motion and in connection with this the authors have observed the changes in the viscosity of cytoplasm during cell differentiation. The cotyledons of the 5—7 day-old seedlings of *Allium cepa* L. seemed to be very suitable in our previous study (FRIDVALSZKY 1957) for the examination of the processes of differentiation in the epidermis. Comparing these examinations to the results of earlier examinations on the leaves of bulb (STRASBURGER 1866, BÜNNING—BIEGERT 1953), BÜNNING 1958) it can be asserted that the differentiation of the protoderm, i.e. the epidermis, takes place essentially identical both in the cotyledon and in the leaf. The difference is that on the cotyledon (at the longitudinal axis of the leaf) the protoderm and its zone of differentiation is much smaller than on the leaf. From this it follows that the differentiation processes take place on a considerably smaller area and in a shorter time than on the cotyledon. Several authors studied the cytological changes accompanying the differentiation of the protoderm. Some included even the leaf of the bulb (BÜNNING—BIEGERT 1953), while others treated the leaves of other species (BÜNNING—SAGROMSKY 1948, LUKAN 1953) but of course mainly of fixed and stained preparations.

Our own microscopic examinations described in the following paper were in all instances carried out on live cells or tissues from preparations made in the following way: the 5—7 day-old seedlings sprouted on wet filter paper in Petri dishes were infiltrated according to STUGGER's method (1949) in a centrifuge. The centrifuge had been employed only until the shifting of cell components occurred. At the same time the infiltrated cotyledons became transparent and the protoplasm of the live, intact protodermic cells became observable through the microscope and, if necessary, even under immersion objectives of high power. This method was necessary because the protoderm could not be separated from the leaf by stripping in such a way that the cells might remain alive.

The cotyledon of the bulb (as well as its leaves) has a basic growth and the differentiation process occurs towards the apex. The lowest cell layer of the protoderm is in direct contact with the rhizoderm of the root and the dividing line is clearly visible (Fig. 1). Thus here the cells formed already with large vacuoles (rhizoderms) are in contact with the less vacuolized meristem cells (protoderm). In the former a brisk circulation can be seen in comparison to the latter where the plasma circulation is much less intense but is — in most instances — observable. In the protoderm the following stages of differentiation or zones can be distinguished (on a span of a few millimeters) if progressing from the base towards the apex. Zone 1: more or less isodiametric cells in which longitudinal but at times multi-directional divisions are observable (Fig. 2); Zone 2: slightly elongated cells due to unequal divisions and each taking one little stoma mother cell filled with plasma at their apex (Fig. 3); Zone 3: two guard cells formed by the equal longitudinal division of stoma mother cells (Fig. 4). The states corresponding to the mentioned zones had been formerly described for the leaf (BÜNNING—BIEGERT 1953) but definite zones could be distinguished only on the cotyledon. In the live protoplasm of cells at the different zones we could examine the following features: weak but recognizable motions occur in the parietal cytoplasm and at places in the forming plasma strands within the first zone. At the boundary of the first and second zones and in the lower section of the second zone there is no directly visible motion. In the upper section of the second zone where the future epidermal cells begin to elongate, simultaneously with the stronger vacuolization, the circulation of the cytoplasm becomes more intensive as well. Plasma circulation together with their growth and vacuolization also starts in the guard cells formed in the third zone. The existence of plasma circulation and its intensity can be justly regarded to a certain extent, as expressive of the viscosity of the plasma. Thus we could conclude that the viscosity of cytoplasm is the greatest in cells that are towards reaching or have already reached



Fig. 1. Area of contact of the rhizoderm and the protoderm of the cotyledon. (*Allium cepa* L. seedling) approximately $200\times$ magnification



Fig. 2. Close-up of the first zone of the protoderm of the cotyledon. Two cells are in equal division. (*Allium cepa* L. seedling) approximately $400\times$ magnification

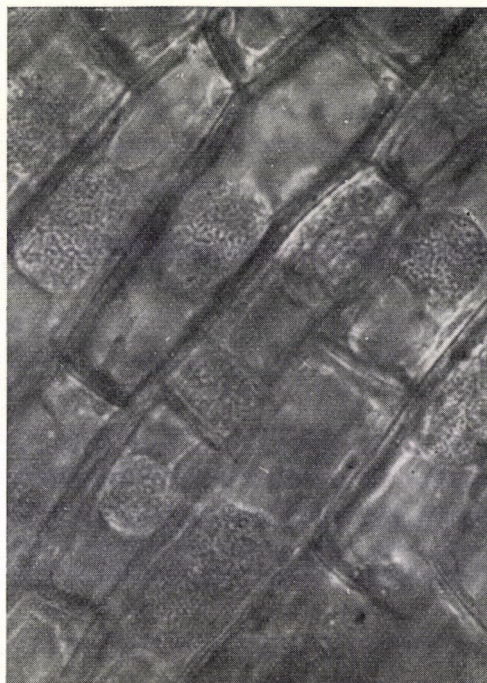


Fig. 3. Close-up of the second zone of the protoderm where the stoma mother cells are being formed with inequal division (*Allium cepa* L. seedling). Approximately $600\times$ magnification

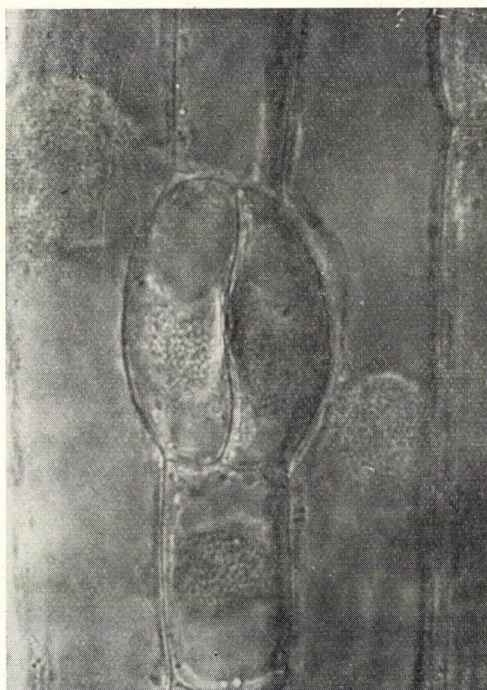


Fig. 4. Close-up of the third zone of the protoderm, where the two arising guard cells are visible (seedling of *Allium cepa* L.). Approximately $800\times$ magnification

the state of inequal division. At the same time this stage of development is the most crucial part of cell or tissue differentiation for the two different cell types of the future epidermis are being formed in it. Since the inequal division means, simultaneously, the polarity manifest in the discussed cells, it is possible that the rather viscous state of cytoplasm has a role in the development of polarity.

Prepared by the Department of Applied Botany and Histogenesis of the L. Eötvös University.

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A FEW PHYSIOLOGICAL FEATURES OF THE BÁNKÚTI 1201 WHEAT

When the *Bánkúti 1201* wheat reached the two-leaf stage of development its roots were removed. The effect of this operation was observed by the manometric measurement of the intensity of respiration of the first and second leaves.

The removal of the root system soon resulted in an increase in the intensity of respiration (JAMES 1953). Respiration in those plants the roots of which had been removed was found to be more intensive in the second leaf from the bottom than in the first leaf. The experiment of UDVARDY—HORVÁTH (1964) shows that in the detached leaves the pentose phosphate shunt probably becomes activated around the alternative respiration types. Besides the in-

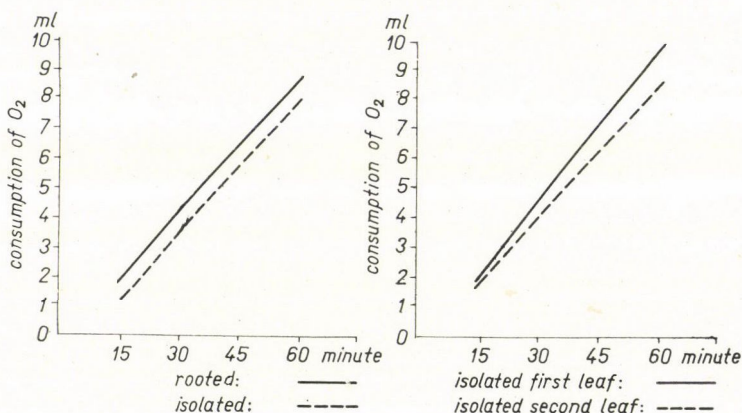


Fig. 1. The intensity of respiration of *Bánkúti 1201*

creasing activity of dehydrogenase in the pentose phosphate shunt, there is — after removing the roots — a striking increase in the activity of several enzymes of the oxidated system. The root plays a role in regulating the respiration types of the leaves.

The measurement of the main enzyme of the pentose phosphate shunt was made for the first and second leaves. The activity of the enzyme is greater in the second row of leaves than in the first since the pentose phosphate cycle — the first step of which is catalyzed by the glucose-6-phosphate-dehydrogenase — is more important in the younger leaf.

The photometric measurement of the activity of peroxidase shows that enzyme activity is greater in the proximal part of the first leaf than at its apex. It is the proximal part of the leaf of the wheat which grows and peroxidase activity — among others — is characteristic of the intensive metabolism related to growth.

In determining the total pigment content it has been found that the apex of the first leaf, which was divided into two parts, contains more colouring matter than the proximal part. There are significant local changes in the colouring content of the leaf: there is a reducing tendency from the tip until the base of the leaf (SEYBOLD—FALK 1959).

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DATA ON THE VOLATILE OIL CONTENT OF THE ORGANS OF ASARUM EUROPÆUM L.

Asarum europaeum L. (Fig. 1) growing wild in the mixed forests of Hungary is a perennial plant containing volatile oil; it has been known and used extensively in medicine for a long time (AUGUSTIN et al. 1948; Soó—JÁVORKA 1951; SPERGELY—TAKÁCSY—NAGY 1961). During the past years several authors reported on the qualitative, quantitative and pharmacological examinations of this plant or rather of its volatile oil. Besides volatile oil they examined in the plant the polyphenol type of compounds, carbohydrates, amino acid spectrum, stearins, the anti-bacterial effect of its rhizome extract (ABDULMENEV 1945; FERENCZY—GRACZA 1957; GRACZA 1964, 1965; GRACZA—CSIZÉR 1965; GRACZA—CSIZÉR—TATÁR 1965; GRACZA—ZARÁNDI 1964; MÉHES 1964; OZAROWSKI 1956, etc.).

The Hungarian pharmaceutical industry has employed it for quite some time for the decoction of its dry rhizomes as component of one of the preparations ("Asaropect") of the Kőbánya Pharmaceutical Factory (MIKOLITS 1960; HORVÁTH 1961). It is used because of its favourable effect in bronchus dilation, relieving smooth muscle cramps and as an expectorant; this is mainly due to the volatile oil or rather to its chief component, asaron.

In consideration of previous results, we extended our examinations to include — in addition to the rhizome — the separated roots and organs above ground (leaf and bud). In this our purpose was to evaluate — qualitatively and quantitatively — the volatile oil content



Fig. 1. Habitat of the *Asarum europaeum* L.

of the mentioned organs. Our samples were collected in the early part of November, 1963, from the vicinity of János-hegy in the Buda Mountains. After separating the organs and doing the necessary preparatory work, we employed Griebel's method, i.e., gravimetric measurement (HALMAI—NOVÁK 1963) in order to make a qualitative test of the volatile oil content. Instead of the pentane described in this method we used petroleum ether with a boiling point below 50° C. In such a way we carried out 4—6 parallel tests and the resulting mean values were included in the pertinent table. Unger's process or rather his modified extractive apparatus (KISS 1941) was found — after trying several volumetric and gravimetric methods — to be the most suitable for the test concerning the volatile oil spectra. In such a way we succeeded in gaining perfectly pure volatile oil with the least danger of decomposition. For the separation of the components of the volatile oil we used thin-layer chromatography method for which the most proper adsorbent was Merck's "Kieselgel G." and as plating mixture benzol containing 5% ethylacetate. An 80% vitriolic solution of 1% paradimethylaminobenzaldehyde resulted in the best developing or differences in the color scale of the components (TYIHÁK—VÁGÚJFALVI 1963).

Depending on the data already mentioned in literature we chose as standards asaron, methyl-eugenol, bornylacetate and a few members of the eugenol series. The pertinent layer chromatography and the few features which could be stated from the chromatogram are given in Fig. 2. In the above cases the amount employed is 10 micrograms each while in case of the volatile oil it was 150 micrograms.

The results gained may be summed up as follows:

There are significant differences in the volatile oil content of organs of dried plants originating from the autumn collection (Table 1). In comparison to the approximately 1—1.2 or 2% volatile oil content of the rhizomes and likely of the attached roots we received 2.18% for the rhizomes separated from their roots. The 1.77% mean value of roots is not much behind these figures. In comparison to the mentioned organs the volatile oil content of the leaves and buds is essentially smaller (0.33 and 0.43% respectively) but these values are not ignorable either.

The volatile oil content of the organs may be studied in Fig. 3. We could also discern differences between the examined organs from the parallel comparison of the spectra as we

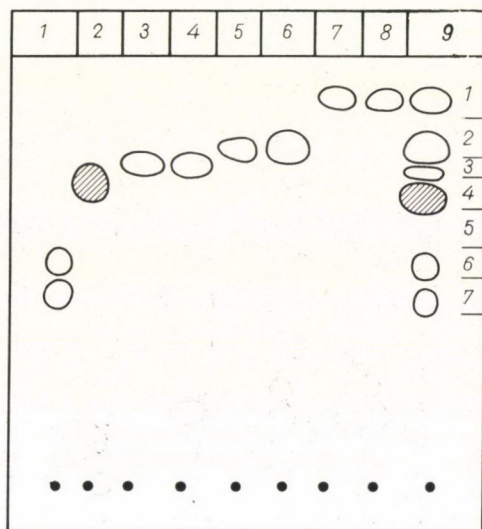


Fig. 2. Thin-layer chromatography of the components of volatile oil selected as standards. 1. Borneol 2. Asaron 3. Eugenol 4. Iso-eugenol 5. Methyl-eugenol 6. Methyl-iso-eugenol 7. Bornylacetate 8. Iso-bornylacetate 9. 1—8

No.	R _f	Uv	H ₂ SO ₄ + p. d. a. b.	H ₂ SO ₄ + p. d. a. b. Uv
1	0.80	—	—	orange
2	0.73	—	pink	violet-blue
3	0.69	—	violet-pink	brownish-red
4	0.64	violet	brown	brownish-green
5	—	—	—	—
6	0.49	—	brownish-pink	brick-red
7	0.44	—	brownish-pink	violet-blue

could in the quantitative examinations too. Namely, according to the method employed, most components can be extracted from the volatile oil of the organs above ground. In case of roots the relative quantity of the components is also the lowest. Asaron known as the main component of this volatile oil can be found in every organ of the plant and the greatest quantity is in the rhizomes. In addition to the appearance of components with an R_f value characteristic of the compound type, significant differences are found during the course of the layer-examination, in Uv light both before and after developing with reagents. This may offer a new prospect to the further study of the rich volatile oil spectra.

On the basis of our examinations carried out on the dry specimens collected in the autumn we can conclude that there are significant quantitative and qualitative differences in the volatile oil content of the various organs of *Asarum europaeum* L. These differences call our attention to the need for the measurement of the pharmaceutical value of organs other than the rhizomes or rather for carrying out further examinations, which would lead to new contributions concerning the treated active agent of the plant, according to season, place

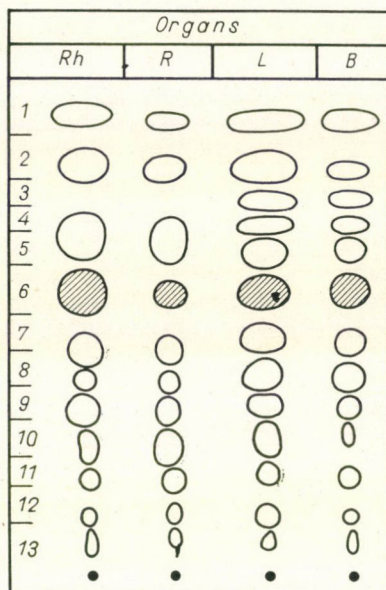


Fig. 3. Volatile oil spectra of the organs of the examined plants of *Asarum europaeum* L. after the performance of the thin-layer chromatography

No.	R _f	Uv	H ₂ SO ₄ + p. d. a. b.	H ₂ SO ₄ + p. d. a. b. Uv
1	0.96	light blue	light brown	violet-blue
2	0.86	—	light brown	violet-blue
3	0.80	—	—	light orange
4	0.75	—	—	light orange
5	0.73	—	pink	violet-blue
6	0.64	violet	brown	brownish-green
7	0.54	—	light pink	violet-blue
8	0.49	—	brownish pink	brick-red
9	0.44	—	brownish pink	violet-blue
10	0.37	—	light pink	light orange
11	0.32	sky-blue	green	brown
12	0.26	—	light pink	violet-blue
13	0.21	—	bluish-green	bluish-brown

of growth and possibly according to developmental stages in order to assure the most favourable raw material with the best volatile oil content or rather with a rich volatile oil spectra for the pharmaceutical industry. Manifold comparative examinations can finally provide useful data to the mean values of different standard specifications.

Table 1

Volatile Oil Content of the Examined Plants of *Asarum europaeum*
L. according to Organ. (Jánoshegy, 1963, XI)

Organ	Volatile oil content %
Rhizome	2.18
Root	1.77
Leaves	0.33
Buds	0.43

Acknowledgement

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*

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THE NEW ECONOMIC SYSTEM OF PLANNING AND MANAGEMENT IN AGRICULTURE AND CURRENT PROBLEMS OF AGRICULTURAL RESEARCH IN THE GERMAN DEMOCRATIC REPUBLIC*

On the occasion of the 13th Agricultural Exhibition of the GDR (13. Landwirtschaftsausstellung der DDR in Leipzig-Markleeberg) the German Academy of Agricultural Sciences (Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin) organized a scientific symposium between the 2nd and 6th of July in Leipzig, to which an eight-member delegation had been invited from Hungary. The delegation was led by Professor GÉZA LÁNG, associate member of the Hungarian Academy of Sciences and included following experts: JENŐ TOTTH, deputy director, LÁSZLÓ CSETE department head, ANDRÁS CSETNEKI research worker, GYÖRGY MÁNDY department head, Professor DÉNES PENYIGEY dean, JÁNOS SARKADI research worker and JÓZSEF CZAKÓ deputy director.

The symposium took place at the KARL MARX University in the Biological Institute of the Medical Faculty. The opening address was held by Professor and Double Honorary Doctor HANS STUBBE, President of the Academy; subsequently four central lectures were delivered. First Minister GEORG EWALD was giving an account of the development of agriculture and agricultural sciences in the GDR during the last two decades. Hereafter KLAUS DYHRENFURTH outlined the new economical system and the tasks of agricultural research attached to it in the GDR. Professor RUDOLF SCHICK dealt with the scientific-technical conceptions of the development of potato growing and finally Professor HANS SCHUMM discussed similar developmental problems of pig breeding. To these points there were several contributions in the afternoon.

On following days the symposium was continued in parallel sections covering two domains each. Lectures and co-reports on agrarian economics and yield formation could be heard July 3, whereas on soil fertility and stock-farming July 5 and 6.

Discourses on agrarian economics dealt with problems pertaining to the enforcement of new economic principles in planning and management.

In the parallel domain physiological questions of yield building in agricultural plants were discussed. First the basic principles of synthetic processes of metabolism in plants during formation, physiological problems of growth and development in connection with manuring and the quantitative analysis of yield building were treated. Subsequently the results of investigations conducted with lysimeters were presented demonstrating the influence of climatic and weather factors on the development and yield formation of plants. The first Hungarian lecture came on in the afternoon session prior to other contributions and co-reports.

GYÖRGY MÁNDY was relating on his ecological investigations under the title "Correlations among the development, morphological yield elements and weather factors". Due to

* German title: »Das neue ökonomische System der Planung und Leitung der Landwirtschaft und aktuelle Probleme der Agrarforschung in der DDR.«

frequently appearing extreme weather conditions in Hungary, investigations into the ecological behaviour of cultivated crop varieties deserve great attention. During his ecological researches lasting ten years MÁNDY had elaborated a new survey method, based substantially on an ecological series set-up by so-called periodical crops (established by delayed sowing technique) with many replications on the same soil. (Fig. 1) In such ecological series the phenology, growth rate and morphological yield elements of plants are surveyed and on the strength of data thus obtained the ecological features and requirements of varieties established.

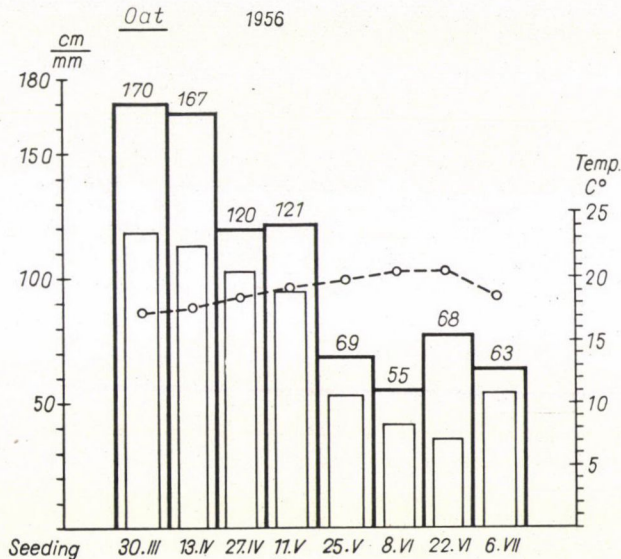


Fig. 1. Ecological series set-up by periodical sowing in an oat experiment. Plant height develops under the influence of most important weather factors (broad columns). On the vertical axis plant height (in cm) and precipitation sum (in mm) and on the horizontal axis sowing times may be seen. Dotted line and the axis on the right side indicate the average temperature (in °C) of the vegetation period

Individually performed registrations have revealed that in stands the dispersion of developmental phenomena is closely connected with the influence of weather factors. This influence is measured with the time interval elapsing between the earliest and latest date of the same phenological phenomenon appearing on plants in a stand and is termed "individual amplitude" by the author (Fig. 2). When most favourable weather conditions prevail the amplitude has the smallest range (i.e. the stand is developing uniformly), increasing considerably under adverse circumstances. In ecological series of periodical crops the amplitude shows a run similar to the dispersion curve, and is, as it has turned out from investigation results, correlated with the change in the values of morphological yield elements. Stands of shorter amplitude have greater yield elements (Fig. 3), and the biological value of their seeds is higher as well.

On examining the amplitude values it has been stated that weather factors have an exclusive genetic impact on the stand, because under unfavourable conditions individuals of non-flexible genetic features either disappear through natural selection (e.g. by winter frost) or their productivity decreases, and they develop seeds of only inferior biological quality; as a consequence, they can hardly propagate and are crowded out from the stand, which becomes, therefore, modified in its genetic composition or even undergoes a transformation.

In the domain of soil fertility, problems of soil cultivation and amelioration were discussed the first day. Some lectures handled the depth of soil cultivation, and others the improvement of highly heavy and muck soils. The *second* day of the conference was devoted to questions of humus management. In the forenoon JÁNOS SARKADI read his paper on "Pos-

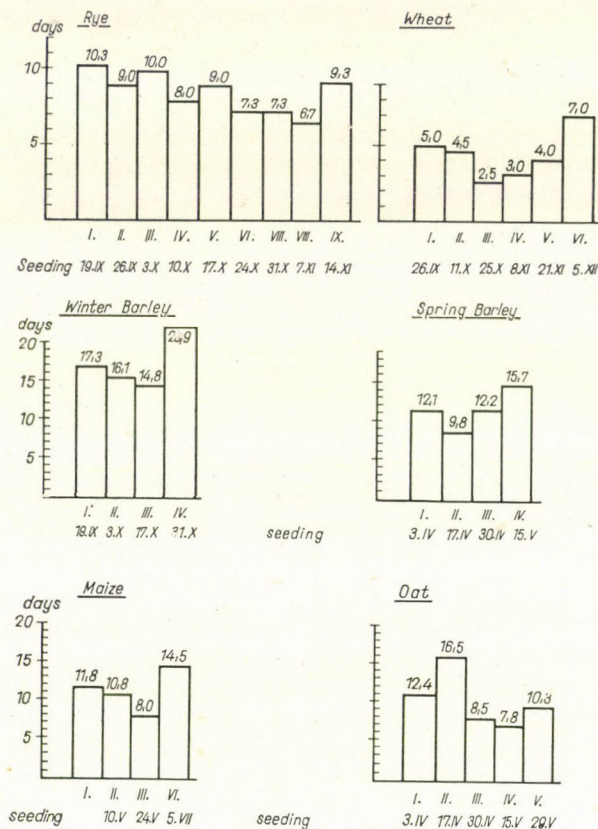


Fig. 2. Individual amplitudes of the earing of rye, wheat, winter and summer barley, of the silking of maize and of panicle formation of oat. Columns of the graph show varietal averages. The distribution of values reminds of the dispersion curve. Ordinate evidences amplitude in days, the abscissa sowing times

sibilities of applying dressing systems without stable-dung in Hungary", in which he reported on some Hungarian duration experiments, examining the influence of different organic manures and fertilizers. Though the quantity and duration of experiments are not yet sufficient to clarify — with validity for all Hungarian soil types — this question discussed for a long time, certain conclusions may already be drawn. According to data obtained so far under the relatively dry climate of Hungary on chernozem- and brown forest soil-like sites with a pH-value above 6, containing 1 to 2 per cent organic C, and not dressed with stable-dung for 15 to 20 years, complete fertilization has not either a minor effect than farmyard-manuring. The chemical analysis of crops brought in proved clearly that — at least in the first 8 to 10 years — the organic N-compounds of barnyard manure had prevailed by about 30 to 70 per cent less than calcium ammonium nitrate. From the data it also turned out that, similarly

to those of most foreign classical duration experiments, between stable-manuring and complete fertilizing no positive interrelation could be found so far.

Problems of humus management were also treated next day in the afternoon E. G. in the lecture entitled "Some operative questions of humus management" by GÉZA LÁNG. Both

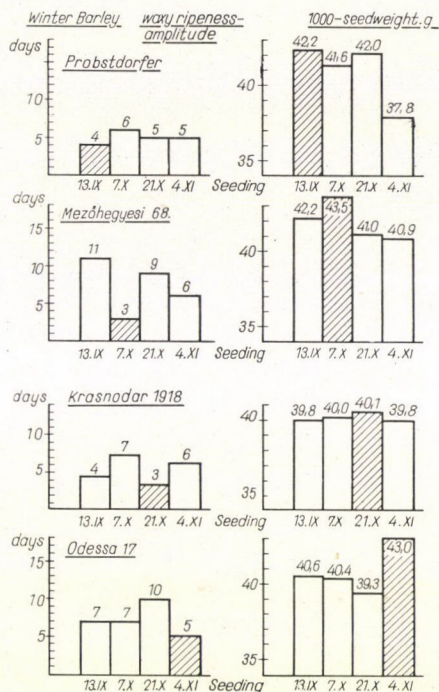


Fig. 3. Correlation of waxy ripeness and thousand-grainweight in winter barley. Smallest range of individual amplitude appears with highest thousand-grain-weight. In graphs on the left side vertical axis indicates the amplitude in days, in graphs on the right side thousand-grain-weight in grams. Horizontal axis shows sowing times. Data of four barley varieties are presented one under the other

basic materials of organic dressing: a) stubble and root remnants as well as by-products of crops and b) the amount and quality of stable-dung are direct dependents of farming system. As cultivated crop varieties and their proportion as well as the quantity of animals producing farm-yard-manure are determined both by the production programme of the farm and by the rentability of production, humus management appears to be a fundamentally important problem. The overwhelming proportion of organic substances produced by farms remains on the spot. More intensive farming involves larger amounts of fertilizers and thus, greater quantities of organic substances, which participate in the internal circulation of farm management, and represent, accordingly, higher value. If only for this very reason is the opinion wrong that an increasing use of fertilizers diminishes the importance of organic manures.

Estimates have showed that taking the present proportion and yield of Hungarian crops into consideration only 20 per cent of organic substances synthesized by plants leave the farms and 80 per cent are left behind. From the organic material being left over in the circulation of farm management 40 to 45 per cent consist of root and stubble remains, 36 to 37 per cent are utilized as forage, and 20 to 21 per cent as litter. With growing intensity of

agriculture the favourable influence of crops on humus management can simultaneously be augmented in three ways: 1. the area of lucerne and red clover might be extended, partly at the cost of other fodder crops; 2. it is possible to curtail the utilization time of lucerne from four to three years; 3. by increasing yield averages the production of stable-dung can be raised and fermentation losses during storage dropped by rational manure handling. Barn-yard-manure is an important link in humus management. The decisive reason of animal husbandry is not to produce more stable-dung, but to satisfy the need in animal husbandry. However, experienced utilization of by-products, chiefly of the stable-dung, is an important factor of rentable farm management. Anyhow, an increasing demand on beef, manifesting itself all the world over, and greater claim to foodstuffs of animal origin even in Hungary, have induced farms to enlarge their cattle stock. All these require increased growing of mass fodders, mainly of papilionaceae, which, again, in a highly raised rate promotes the augmentation of organic substance unit favourable to soil fertility partly by root and stubble remnants and partly by the production of stable-dung. This process is advanced beneficially by the use of larger fertilizer quantities and must, therefore, be examined as a central problem in further researches. Exactly, it should be found out what is the most rentable and least labour-intensive utilization of organic substances increased by higher fertilizer doses and remaining in the circulation of farm management, in order to raise soil fertility to the highest level in modern big estates.

In the domain of cattle husbandry the augmentation of milk production was the central problem of the two-day-session pointing out that more intensive, and gradually industrialized production methods must also be enforced in cattle farming. In the framework of many lectures a co-report was delivered by JÓZSEF CZAKÓ under the title: "Problems of development in large dairy-farms" ("Probleme der Entwicklung großer Milchviehbestände"). The socialist reorganization of agriculture has caused essential changes also in Hungarian cattle husbandry, requiring specialization and concentration. Parallel with higher intensity both of these requirements demand the turning out of cheap and uniform produces promoting simultaneously industrial features in processing. Industrialized large dairy-farms need a complete set-up performing all production processes alone. It must be stressed, that concentration and specialization, in themselves, do not suffice, this has been proved by Hungarian experience showing that large establishments have not succeed in augmentation of milkproduction. These unfavourable results do not mean, of course, disapproving an effort like this only point to the fact that when large establishments are built up, not only quantitative but also qualitative changes should be taken into consideration. Most difficulties arise in large-scale foraging, because cattle farming is far more earth-bound than the other branches of animal husbandry. Large dairy-farms are doubtless dependent on mass fodders, and these must be made available for dairy-farms steadily and nearly in identical quality by agricultural estates, eliminating also the possible fluctuations of growing. As to food supply large dairy-farms must be cut free from weather conditions; this can be achieved in several ways. It seems most feasible to base feeding on mass fodders which may be stored in almost identical quality and fed independently from weather for the whole year. In the industrialization of cattle farming it is also important to render the fodder supply as simple as possible, i.e. to decrease the number of crop varieties. This should, however, be solved without diminishing the biological value of fodders. The more the mass fodder supply will be simplified, the less we can miss industry-produced fodder supplements (vitamins, mineral salts etc.). The other big problem in establishing large dairy-farms is to provide steadiness in calving, this being a prerequisite of uniform milk-production. The establishment of large dairy-farms needs also detailed technological prescriptions for production processes. In industrialized dairy-farms not cows producing record quantities of milk but rather individuals of continuous and reliable yield are — of course — wanted. In centralized dairy-farms satisfactory productive capacity of animals can

only be expected if disadvantages caused by the lack of individual tending will be counter-balanced by biologically valuable fodder, better stabling and improved veterinary attendance.

The second day of discussions on animal husbandry a co-report was also delivered by LÁSZLÓ DETRE on problems of large-scale green fodder seasoning.

Once discussions being concluded instructive study tours were made by the participants visiting different institutions and co-operative farms.

GY. MÁNDY

A NEW CELL-TYPE OF "TRANSITIONAL" CHARACTER ON THE BORDER OF THE ADRENAL CORTEX AND ADRENAL MEDULLA

The capacity of certain glands to develop secretion products being of different chemical structures, has been well-known for a long time, however, the structure that is capable to organize that rather complicated physiological process, has been hardly known up till now. Of the numerous examples the pancreas deserves special attention since in it the occurrence of the exocrine, and endocrine secretion activity within the same cell has been proved by light- and electron microscopic examinations (LAGUESSE 1896, ZAGURY et al. 1961). Thus, it might seem but little astonishing that such "transitional" cells in which both the cortical and medullary cell organelles can be found, are contained in the purely endocrine adrenal, too. In spite of this,

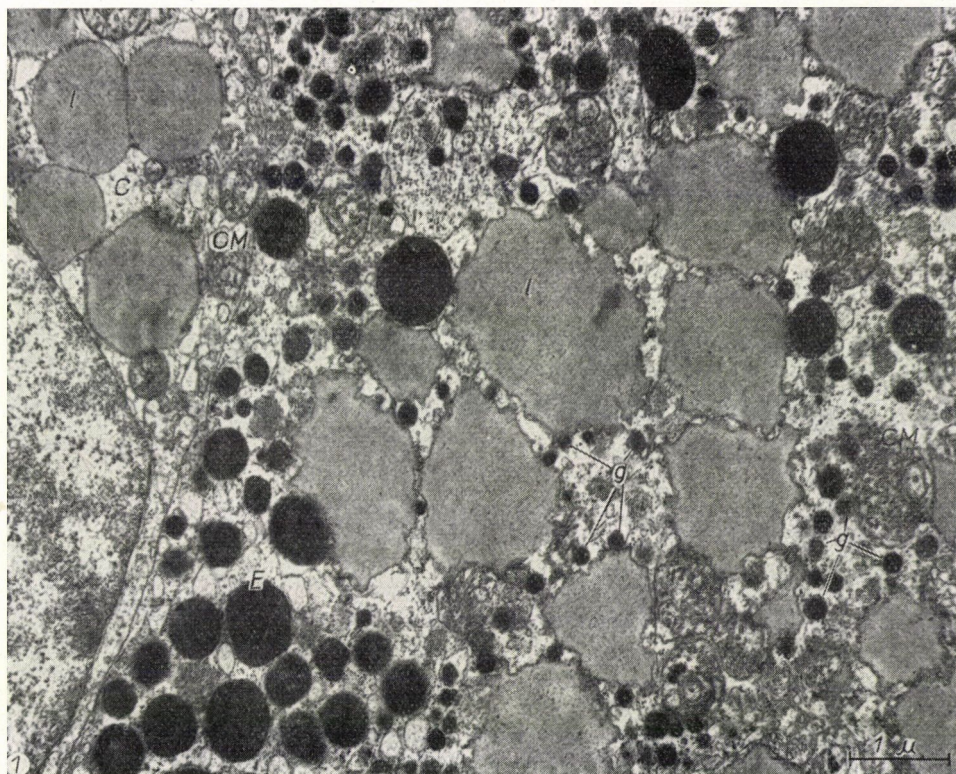


Fig. 1. Section of the "transitional cell" from the frog adrenal

the phenomenon might be considered unusual because text books- and literary references have stressed up till now the basically different developmental, morphological and functional peculiarities of the adrenocortex and medulla. Our observations have been extended both to inferior (frog) and to super or (rat) animals. Fig. 1 shows the cell section of frog adrenal. In the cell-segment (on the left side of the Figure) there can be seen only the cell-organelles characteristic of the cortex cells (C) (lipid droplet: 1, tubular mitochondria: CM). In the neighbouring cell

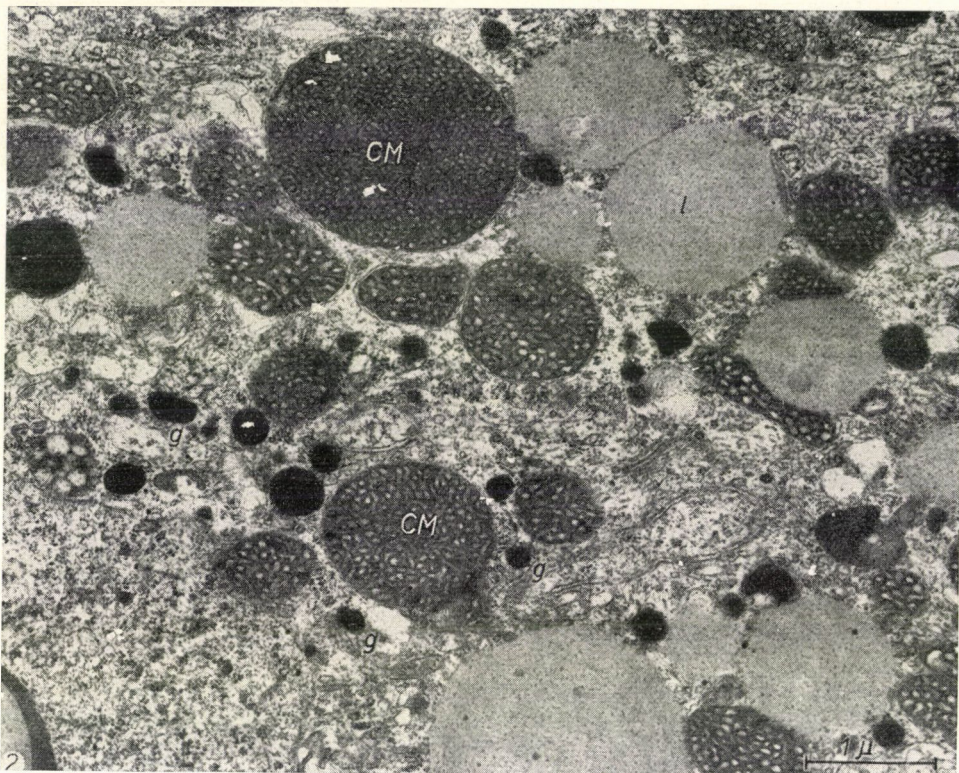


Fig. 2. Electron microscopic picture of the "transitional cell" from the frog adrenal

besides irregular lipid droplets (1) being illustrative of the cortex, eosinophil granules (E) and tubular mitochondria (CM) also catecholamine granules being characteristic of medullary cells may be in great number observed. Tubulo-vesicular mitochondria characteristic of the fascicular zone, in the adrenal gland, roundish lipid droplets (1) and catecholamine granules (g) occur together also in Fig. 2 representing the frog adrenal. As mentioned previously, the phenomenon can be observed in the rat adrenal, too. Fig. 3 shows the border of medulla-cortex. Accordingly, on the top of the Figure a segment of the medullary cell (MC) may be seen in the cytoplasm of which numerous catecholamine granules (g) take place. In the interstitium (is) next to the medullary cell the cross sections of the collagen fibres (K) and the cell-part (Fb) of a fibroblast are visible. The lower and right parts of the Figure represent a cell-type (Tc) of transitional character in which numerous catecholamine granules (g), cortex mitochondria of vesicular type (CM), some mitochondria with cristae (MM), being characteristic for such kind of medullary cell, can be observed together.

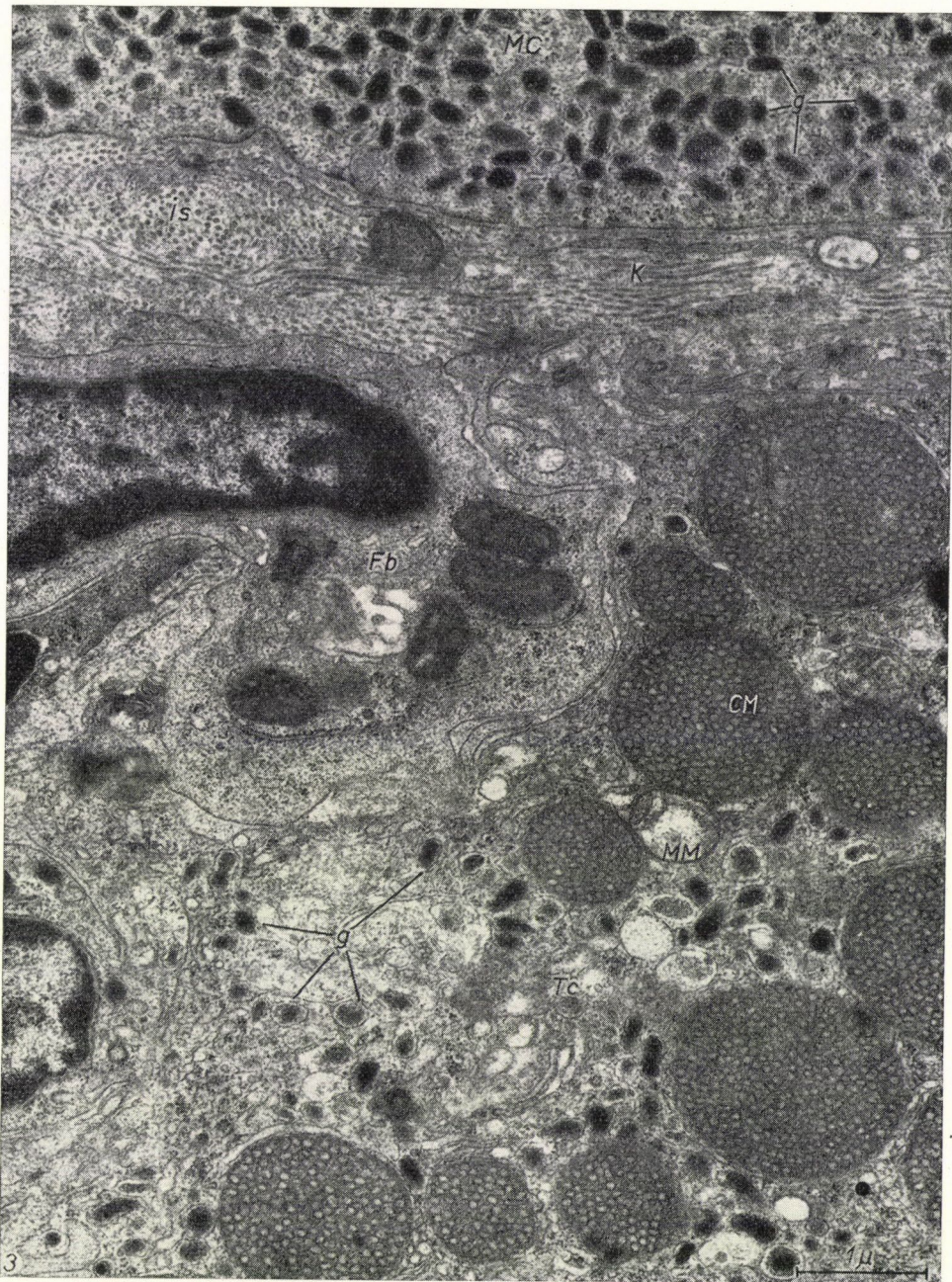


Fig. 3. Rat adrenal "transitional cell", a part of the medulla and fibroblast

The cell-biological and functional importance of gland-cells being morphologically of "transitional" character, are far from being explained. According to some observations (WOERNER 1938) after the dosing of sugar and cortisone as well as ethionine treatment, the pancreas acinus cells get transformed to islet cells (GUSEK et al. 1959, LAGUESSE 1896). That phenomenon could be observed on the surface of contact.

It is also well-known that the ACTH treatment might result in the entire disappearance of the glomerular zone of the adrenal (SABATINI et al. 1961). On the pressor-amine and catecholamine content of adrenal and the extramedullary chromaffin tissues numerous biochemical examinations have given account (EULER 1956); on the basis of these data we know the most divergent kinds of tissues (heart muscle, spleen, brain tissue, adipose tissue, etc.) to contain adrenaline or noradrenaline. In spite of the above observation on the transformation of cortex cells to medullary cells and the appearance of catecholamine granules within the cortex cell, respectively, regular light- and electron microscopic examinations have not yet submitted reports. Though ERÄNKÖ et al. (1960) published electron microscopic Figures showing, in the rat adrenal medulla, atypical medullary cells and cell components (so-called "vesicle containing spherical body") as well, but he did not consider the phenomenon observed a typical form of cortico-medullary organisation. With the development of preparative methods it has become sure that the phenomena as observed by ERÄNKÖ, correspond with the cortical-mitochondria of slight structure. Since our pictures have been made with glutaraldehyde prefixation and osmium fixation, and the cell components have kept their structure well, we are of the opinion that the observed transitional cell-type is not an artificial product of preparation but a real, existing structure in the explanation of which several suppositions might arise:

1. The transitional character of the cells has developed for supplying a special cortico-medullary function.

2. Since in the frog adrenal the transitional cell-type can be met with more frequently, the occurrence of it in the rat adrenal medulla might be "atavistic". Parallel with our electron-microscopic examinations we have also performed light microscopic chromaffin reaction and have established that in the adrenal cortex numerous cells showing positive chromaffin reaction can be observed (BENEDECZKY). In lack of other data the above suppositions are insufficient for understanding the function of cells being of transitional character, and many a physiological and biochemical examination is needed to expound the cell-physiological role of that peculiar submicroscopic organisation.

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A FEW PHYSIOLOGICAL CHARACTERISTICS OF THE MFB VARIETY OF BARLEY

We have examined the change in the quantity of ascorbic acid found in the proximal, medial and apex portions of the first leaf of the barley plant on the second, third and fourth days after detaching. It has been discovered that the detached leaves contain more ascorbic acid than the intact control leaves. This is attributed to the increased activity of the dehydroascorbic acid — reductase enzyme. The quantity of ascorbic acid was greatest at the apex of both the detached and intact leaves.

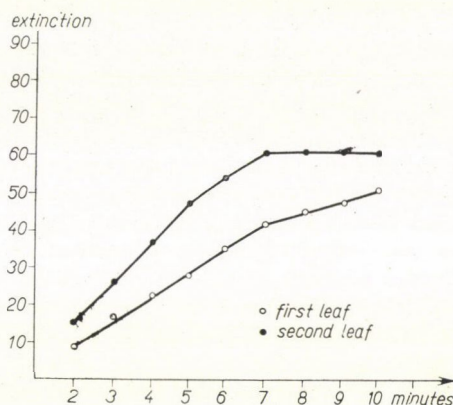


Fig. 1. The activity of glucose-6-phosphate dehydrogenase

Enzyme activity increased at the apex in proportion to the time elapsing since detachment. Such an increase in enzyme intensity and in the amount of ascorbic acid indicates the greater role of the ascorbic acid system in detached leaves (HORVÁTH—UDVARDY 1965).

The increased activity of the glucose-6-phosphate dehydrogenase as the main enzyme of the pentose phosphate shunt under the effect of detaching seems to prove these results (KISBÁN et al. 1964) if we consider that TPN (NAD-P), a co-enzyme, is indispensable to the functioning of the ascorbic acid—glutathione system. The determination of enzyme activity in the first and second leaves shows that enzyme activity is lower in the first leaf than in the second, younger leaf. The greater G-6-phosphate dehydrogenase activity in the young leaf proves the increased activity of the ascorbic acid system and supports the hypothesis that the system plays a more prominent role in the respiration of younger parts of the plant.

An examination of the activity of the peroxidase enzyme indicates that there is more activity in the proximal portion of the first leaf than in its apex.

Measurements of the intensity of respiration prove that there is a greater increase in the respiration of the second leaf of rooted plants; this is understandable because it happened to be a young and growing leaf.

The examination of the total pigment content indicated that there had been more pigment in the apex of the first leaf than in the proximal portion.

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EXAMINATION OF THE EFFECT OF GLUTARIC ALDEHYDE FIXATION ON THE EPIDERMIS CELLS OF ONION

The fixing substances used in light microscopic microtechnique — due to the coagulation of proteins, — generally destruct the protoplasm in a rough way and distort — to a great extent — the natural plasma structures. This effect is mainly attributed to their highly acidic nature (ROZSA—WYCKOFF 1950). It was only osmic acid being but slightly of dissociating character and the watery solution of formaldehyde that sometimes gave promising results. In electron microscopic examinations the good preservation of plasma structures is especially important and thus it is understandable that the technique of fixation has recently developed primarily in connection with ultrastructure studies. ZEIGER (1949) pointed at the circumstance that an important precondition of good fixation is also the simultaneous stabilization of lipoids. With electron microscopic fixation the neutralized watery osmium tetroxide solution and the potassium permanganate solution proved to be the best (PALADE 1952,

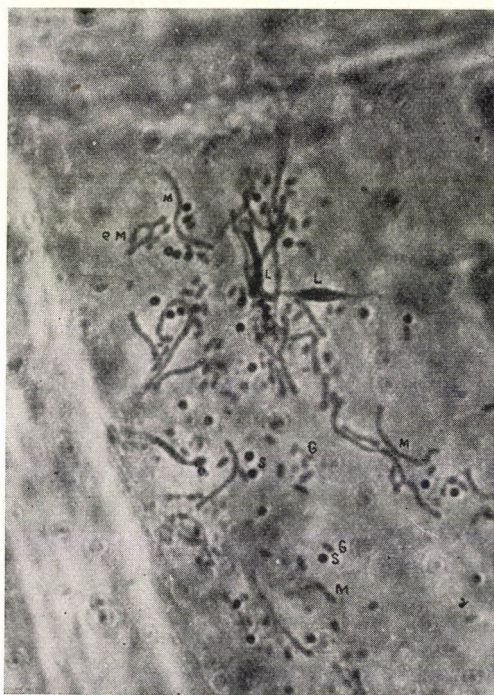


Fig. 1. The living cytoplasm of the *Allium* epidermis cell, with elongated mitochondria. About 900 × magnifying. M mitochondrium; e M Branching mitochondrium; G Golgi-apparatus; S sphaerosome; L leucoplast. (Phasecontrast-microscopic picture)

LUFT 1956) which, through gentle transformation of the plasma proteins, by way of their probable gelification (not denaturation) and stabilization of the lipid membranes, produce the proximate criteria of ideal fixation.

The substances mentioned are generally good at fixing the cells of animal tissues and those of plant meristem-tissues. However, with developed plant tissues containing big vacuoles, they generally did not prove to be suitable even if sugars were dissolved in the fixing substances in order to eliminate the harmful effect. In the case of vacuole cells it often occurs to be damaged not only the microscopic structure of cytoplasm there is also a considerable and unnatural change in the original cytoplasm configuration.

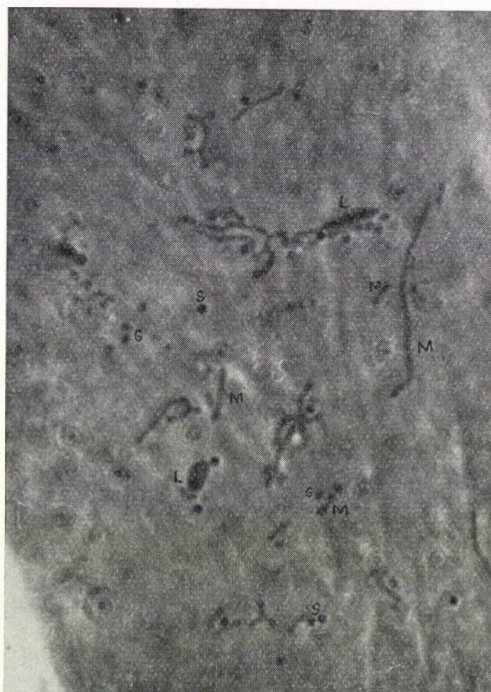


Fig. 2. The cytoplasm of *Allium* epidermis cell fixed with glutaraldehyde. Approx. 900 \times . M mitochondrium; G Golgi-apparatus; S sphaerosome; L leucoplast. (Phasecontrast microscopic picture)

In our investigations we have studied the fixing effect on the cytoplasm of cells with big vacuole. The object of our examination was the epidermis in the squama leaves of *Allium cepa* L. Glutaraldehyde fixing had been introduced by SABATINI—BENSCH—BARNETT (1963) for the cytochemical and electron microscopical examination of cells in animal tissues. According to experiences that substance, when buffered in a proper way, proved to be excellent for maintaining the cytoplasmatic ultrastructures even in case of meristem plant cells (LEED-BETTER—PORTER 1963). Since contrary to osmiumtetroxide and potassium permanganate, it does not cause discolouring, — it deemed to be practical in this respect, too, to try to make use of it in light microscopic examinations. In our examinations we have prepared the onion epidermis availing ourselves of STRUGGER's method (1949). Applying phase contrast microscope in the living epidermis cells, the cytoplasm which forms in the majority of cells a sack

along the wall is easy to be detected. In the basic substance of the cytoplasm appearing to be homogeneous, there attract attention cytoplasm-organelle, mainly leucoplasts, mitochondria, small and big sphaerosomes (URL 1964), as well as the dyciosomes of the Golgi-system (JAROSCH 1961, URL 1964), which under the effect of streamings which move to and for changing direction and occurring in the basic substance. (Fig. 1)

The effect of fixation had been studied directly and continuously by phase contrast microscope in a way that 25% glutaraldehyde solution adjusted to 7–7.5 pH with sodium-cacodilate buffer, was forced through by suction under the cover sheet. In order to be able to study more properly phenomena occurring on moving films, microkinematographic pictures,

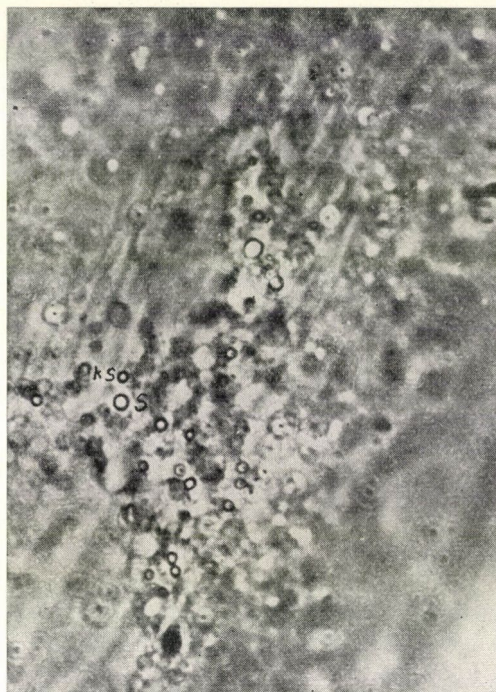


Fig. 3. Cytoplasm of *Allium* epidermis cell after a treatment with Bouin-fixative. Approx. 2000 \times . S sphaerosome; k S small sphaerosome. (Phasecontrast microscopic picture)

too, were made. The first sign of fixation could be experienced differently with each cell after 2–15 minutes had elapsed. These divergencies might be explained by the fact that on the lower part of the separated epidermis there had remained also mesophyllum cells delaying the direct penetration of glutaraldehyde into the epidermis cells. As a beginning of the effect a somewhat more vivid moving of the cytoplasm-organelle could be observed which allows us to conclude that the viscosity of the plasma had decreased. When after the addition of the fixative, a 3–5% KNO_3 solution is given directly to the tissue, we generally experience the signs of convex plasmolysis, and this also shows a lesser viscosity of cytoplasm. The vividness in organella motion was followed by a gradual but relatively quick slowing down for 1–2 minutes, and this was followed by entire standstill. Plasmolysing now attempted, had no result showing that the plasma had decayed. The picture taken two hours after the complete stopping of cyclosis (Fig. 2) shows that the cytoplasmatic basic substance remained

homogeneous and the organelle, too, seem to be unchanged. Both the short and long mitochondria can be found just like in the living state. Especially conspicuous is the considerate effect of glutaraldehyde when compared with the effect of a customary fixing agent, e.g. the Bouin-fixative which results in the hard precipitating of the plasma basic substance and the decaying of the mitochondria (Fig. 3). In the course of our experiment, there sometimes developed gradually smaller vacuoles in the cytoplasm as an effect of glutaraldehyde. One stage of this process is shown in Fig. 4. As the process progressed, the cytoplasm became of a foamy structure. HÖLZL (1964) has described a similar phenomenon in the cytoplasm of the onion epidermis cells after potassium permanganate fixing. He considers this structure,

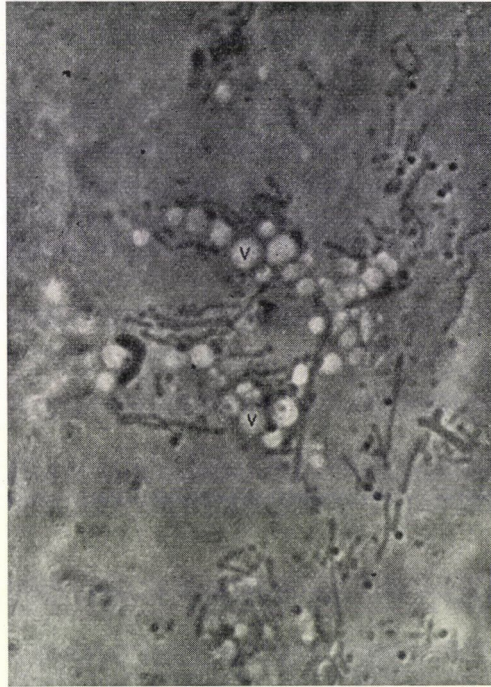


Fig. 4. Vacuolization in the cytoplasm of the *Allium* epidermis cell effected by glutaraldehyde. Approx. 900 \times . V vacuolum. (Phasecontrast-microscopic picture)

— being otherwise light-optically invisible, — an endoplasmatic reticulum being rough in structure as a result of fixation and thus becomes visible. Thus, in this latter case we have to deal with an indulgent, however, bad fixation; this can be explained by the more sensitive state of the cell plasma in question or by the fixative not penetrating properly.

We wanted to submit approximate information on the extent at which the glutaraldehyde fixation maintains the structure of plasma-proteins. For carrying out such an experiment fluorescent microscopic examination of cells being stained *in vivo* with acridine orange, seemed to be suitable. Staining occurs in a way that the cations of the dissociated stain molecules get bound to the negatively charged groups of the proteins (STRUGGER 1940). The fluorescent colour of the stain depends on the concentration i.e. in lower concentration its fluorescence is green, while in higher concentration this is red. According to STRUGGER (1940, 1949) the cytoplasm and the cell nucleus display greenish fluorescence as they can bind but little stain-

cation, while those of died or killed off cells, are red since a big quantity of stain-cations is bound to the coagulated plasma-proteins.

According to STRUGGER through staining with acridine orange it can be decided whether the cell is living or not. Our fluorescent microscopic examinations proved that the cytoplasm and the nucleus of cells being fixed with glutaraldehyde and stained with acridine orange displayed the same fluorescence as that of living cells. From our observations we concluded that buffered glutaraldehyde maintained also the original molecular structures and changing conditions. Therefore the statement according to which the limited accumulation of acridine orange in the plasma protein was the result and at the same time, the sign of the living state of the cytoplasm, cannot be considered generally and principally valid.

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MEASURING PEROXIDASE ENZYME ACTIVITY IN BARLEY AND WHEAT SEEDLINGS

The peroxidase enzyme plays an important role in oxidative metabolism; this explains its popularity among the experiments carried out in recent years. The purpose of the present experiment was to examine the changes in peroxidase activity in barley and wheat plants between 7 and 14 days of age, to compare the peroxidase enzyme activity of the first and second leaves and further, to examine whether in case of individual leaves the greatest enzyme activity occurs in the apical, central or basal section of the leaf. Experiments were carried out on *Bánkúti 1201* winter wheat variety and on the *MFB* barley variety.

Similar experiments were done by PÜL'NEV (1961). He examined peroxidase activity in the generative organs of spring wheat and found that — on the basis of enzyme activity — it was possible to select the best parental partners for crossing. Namely, increased enzyme activity indicates greater viability. PERUR (1962) measured peroxidase activity in the tissues of plant leaves and he tried to discover the optimum circumstances in which enzyme activity

was least disturbed. We can find a significant number of other experiments on peroxidase. In case of maize, barley, carrots, and sugar beets the effect of cyanamide has been examined in connection with enzyme activity (AMBERGER 1961). The effect of gibberellin on the activity of the peroxidase enzyme has been examined in the dwarf strains of maize and peas (McCUNE 1959). Others have treated how Fe, Mg, B, Mo influence peroxidase activity.

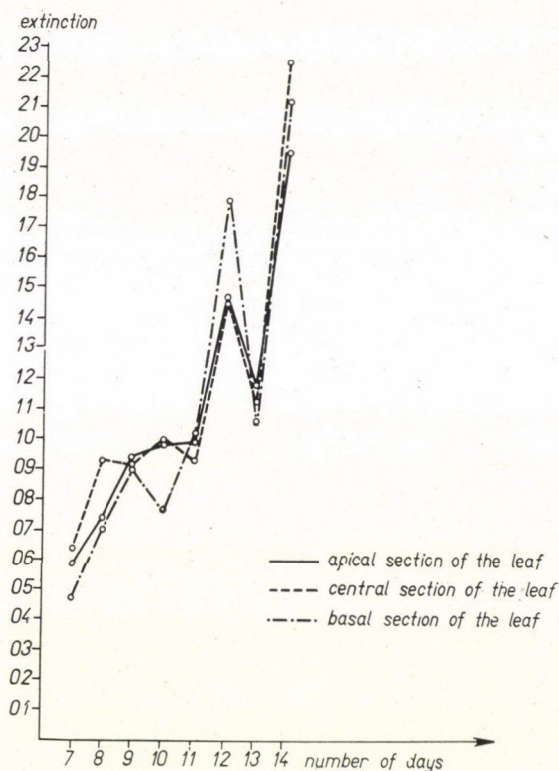


Fig. 1. Peroxidase activity of the first leaf of wheat

In the present experiment we used plants grown in the greenhouse. Peroxidase activity was tested with the guaiacol method and measured with a Spectronom 201 photometer at a wave length of 420 millimicrons. We were interested in the relative changes in peroxidase activity.

The figures show that the peroxidase activity of wheat increased in all parts of the leaf at least between the 7th and 14th days from the time of sprouting. During this period the course of the increase is interrupted. In case of wheat the increase is less from the 7th to 11th days, but then it increases. The activity in case of wheat does not proceed parallelly in the basal, central and apical sections of the leaf: first it is greatest in the central section and lowest at the basal. Later a change occurs: the activity of the apical and central sections increases although the peroxidase activity of the base increases to such an extent by the 12th day that it surpasses the activity of the two other sections by approximately 20%. Afterwards this difference again becomes indistinct.

On the 11th day the second leaf begins to develop. The transitional change in the enzyme activity of the base is coincident with this. A relation cannot be proved to exist between the

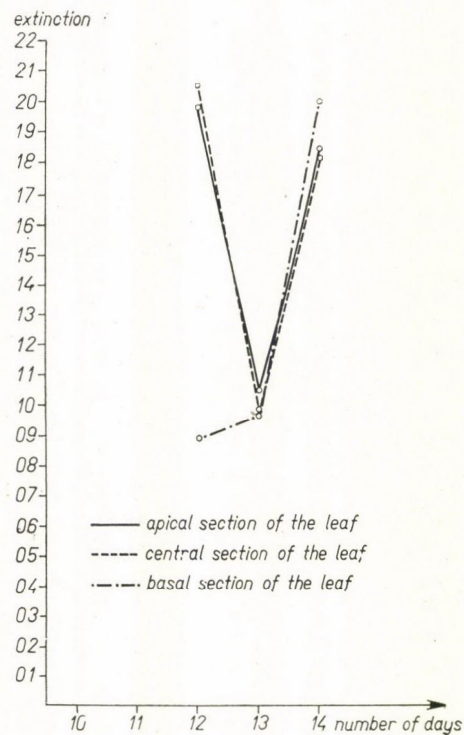


Fig. 2. The peroxidase activity of the second leaf of wheat activity

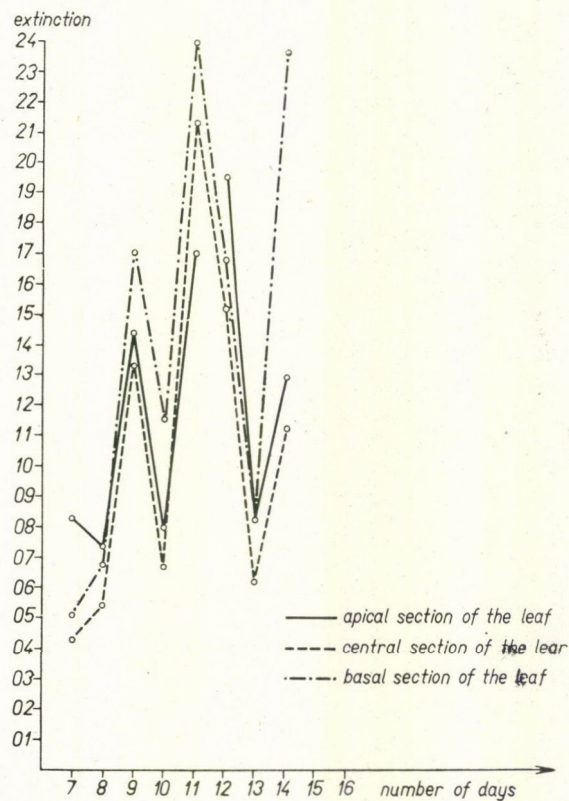


Fig. 3. The peroxidase activity of the first leaf of barley

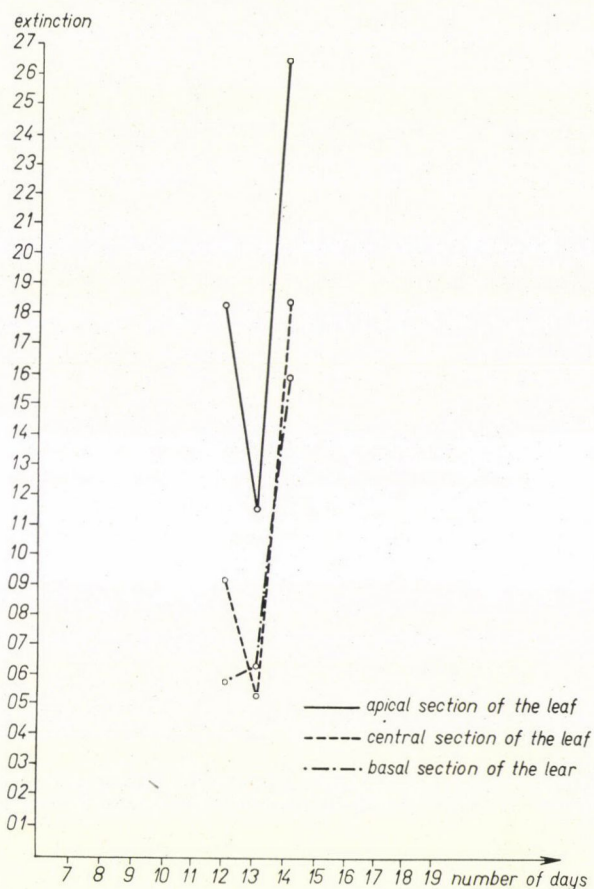


Fig. 4. The peroxidase activity of the second leaf of barley

occurrence of the second leaf and the former change; in case of barley the enzyme activity of the base is greatest from the 8th day whereas here the second leaf starts to develop only later.

The peroxidase activity of the second leaf is also interrupted in both plants. It was possible to divide this leaf into three measurable quantities only from the 12th day of growth, then the enzyme activity of the second leaf becomes greater than the first. Otherwise the course of the activity is strikingly harmonized in the two successive leaf rows.

The curve made of the peroxidase activity of the barley differs from that of the wheat in that the former is more interrupted.

If we compare peroxidase activity according to the appropriate days, then we may state that the peroxidase activity of barley seems to be generally higher than that of wheat. This is likely to be the result of greater fluctuations only. Probably the most characteristic difference between the two plants is that peroxidase activity in the basal, central and apical parts of the barley leaf differs to a greater degree than that of the wheat leaves.

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HISTOLOGICAL EXAMINATION OF ADONIS VERNALIS L.

We have carried out histological examinations on the organs of *Adonis vernalis* L. used in pharmacology.

The plants for our studies were collected on the southern slope of Hármashatárhegy.

Manual cross sections were made and the protoplasm oxidized for the histological examinations on the basis of SÁRKÁNY—SZALAY (1964).

We have examined several rhizomes and studied the roots emanating from them; we could make no distinctions between them as to arrangement, but we have succeeded in determining histologically that there are two types of root systems (similar to MÁNDY 1928) termed by us as anchoring and storing ones. In the following table we have summarized our statements on the different arrangements and thicknesses of the developed roots originating from a rhizome:

Number of the root	Arrangement of the root	Size of root	Part near to the rhizome	Part farther from the rhizome 3—4 cm	Number of bundles xylem	Phloem
1	growing from bottom	thick*	storage	storage	4	4
2	from top	thin**	storage	anchorage	4	4
3	from top	thick	anchorage	anchorage	4	4
4	from bottom	thin	anchorage	anchorage	4	4
5	from bottom	thick	anchorage	anchorage	7	7
6	from top	thick	storage	storage	7	7

*5—6 mm

**2—3 mm

The tissue structure of anchoring roots is as follows: on the outermost surface we can see the exoderm which is composed of a few layers of corky cells. Under it we find the polygonal, thin-walled parenchymatous cells of the cortex with small intercellulars. The plasm of the cells is rich in various materials (oil, starch).

The cortex is separated from the central cylinder by an endodermis with Casparyan strips and in older roots by the endodermis in a tertiary state of development characterized by the thickening of the radial and inner tangential walls. The outer layer of the central cylinder is the pericycle which is a small parenchyma of two-three layers of cells. The simple xylem and phloem bundles of the root are located near one another and in older plants a wavy cambium is formed between them. Besides the components of the mestom, we can find scattered fibres in the bundles. The vascular system of the xylem has reticular, scaliform and

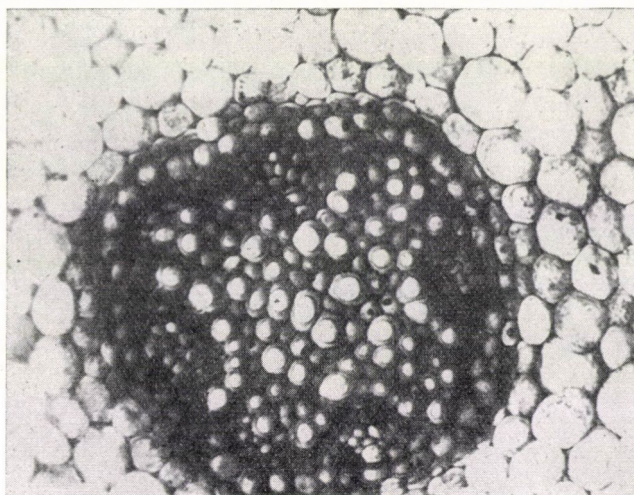


Fig. 1. Cross-section of an anchoring root. Magnification: $60 \times$

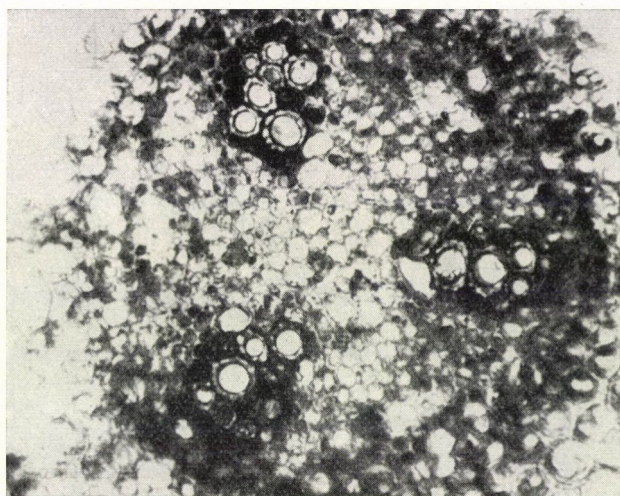


Fig. 2. Cross-section of a storing root. $M = 60 \times$

transversely-split, pitted wall thickenings. The woody parenchyma is thick-walled with simple pits. The vascular bundles number approximately four but may even reach seven.

In the central cylinder the xylem bundles meet in the middle. The anchoring roots contain no pith (Fig. 1).

The tissue structure of the storage roots differs from that of the anchoring roots, in that the number of vascular bundles is generally 3–5. The bundles are separated from one another by relatively broad parenchymatic pith rays; there is also a considerable amount of pith in the centre which is rich in stored materials (Figs. 1 and 2).

We could not observe any fibres in the vascular bundles.

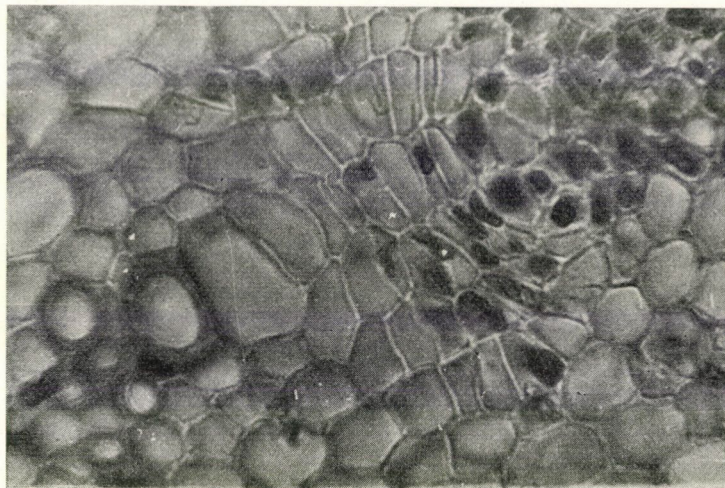


Fig. 3. Detail of the collateral open vascular bundles of the stem. $M = 500 \times$

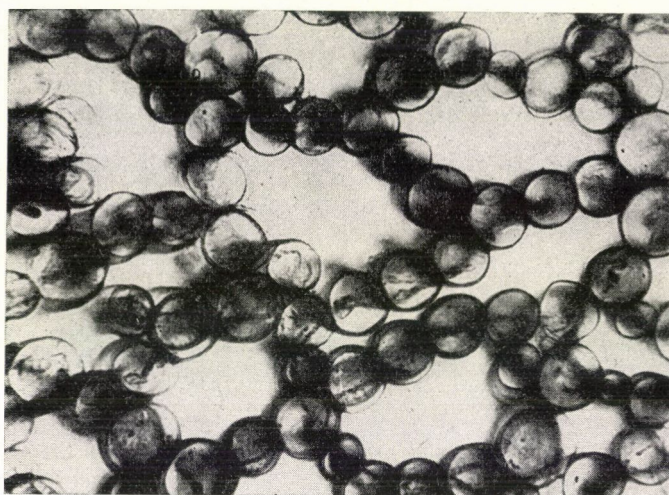


Fig. 4. Basic structure of the pith (stem). $M = 500 \times$

The surface of the stem is covered by a single layer of epidermal cells with scattered stomata. The cortex is parenchymatic with irregular rounded cells. The vascular bundles are collateral and open as it is usual in the Ranunculaceae family (Fig. 3), and they form a circle.

On the lower part of the stem a considerable crown surrounds the phloem part of the bundle. This phloem crown is composed of sclerenchymous fibres. There are no fibres in the vascular bundles. In comparison to the cross-section of the stem, the pith is extensive and in our specimens it was in all instances composed of very loosely structured parenchymous tissues (Fig. 4).

Both the upper and lower epidermal cells of the leaf have wavy walls, although those of the lower epidermis are more wavy. Their shape is irregular and in some cases the wrinkling

of the cuticle is observable. Stomata were found only in the lower epidermis of the leaves; this disagrees with examinations of SOLEREDER (1908). The guard cells have an elongated kidney shape. On the lower epidermis we found scattered single-celled, blunt, thin-walled branched hairs and two-celled smaller glandular hairs. The mesophyll has a bifacial structure. The palisade parenchyma is composed of a single layer of short cells. The spongy parenchyma has two-three layers and a loose structure. The trachease and tracheids of the vascular bundles have spiral cell thickenings.

The cells of the sepals have slightly wavy walls. There are stomata and branched hairs on the lower epidermis.

The crowded pitting of the cell wall of the lower epidermis is a characteristic phenomenon. The epidermal cells of the petal have a flat, rectangular shape and straight walls. Their surface is covered with a wrinkled cuticle. Neither stomata nor hair formations are observable.

After the general histological examinations we shall continue our study of the histochemistry of the stored matter of *Adonis vernalis*.

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*

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I. KORBÉLY, A. RIXER

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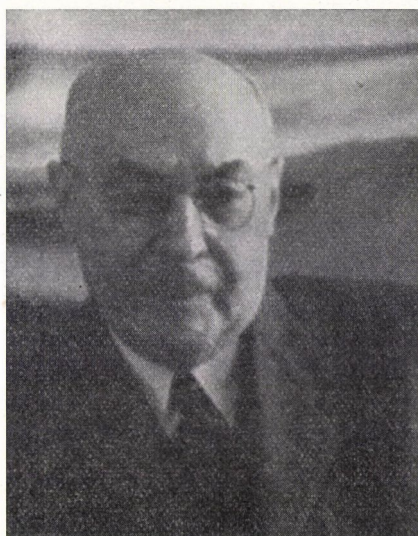
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CHRONICA

JÁNOS SURÁNYI

1886—1965



“No one is indispensable” goes the well-known but ambiguous proverb which rather than being true serves to console society. History rarely succeeds in providing adequate substitutes for those great men who have contributed to progress. Similar personages able to take the lead, to continue in the footsteps of their predecessors or advance creative work at the same uninterrupted pace and in the same spirit are very exceptional.

Likely many of us thought of this when we learned of the death of János Surányi, the Nestor of Hungarian agriculture. Although we knew about his long illness, his lonely five-year long struggle with death which neither medical science, good will, nor sacrifice could alter, the news still came as a shock. Then we could not escape the fact that Hungarian agriculture and science lost a great man possessed of a tremendous range of knowledge.

And at the same time we felt that someone irreplaceable had been taken from us.

We miss him because he was the last of a pioneering generation which at the end of the last and well on into this century developed and shaped the science of plant production in Hungary to such a degree that it reached European standards. The milestones of their accomplishments are permanent and mark the trend of agriculture as well as indicate the future course of development.

János Surányi's career and scientific activity began at the National Experimental Station for Plant Production at Magyaróvár in 1906. After a quarter of a century of experimental work he became director of the Experi-

mental Station at Magyaróvár, a position that he held between 1933 and 1937. Following in the footsteps of his great predecessors at Magyaróvár, Cserhádi and Gyárfás, he found many ways to develop and advance the up-to-date scientific research during this period.

In recognition of his scientific and research activities, the Technical and Economic University appointed him professor at the Institute of Plant Production of the Department of Agriculture following the retirement of Kálmán Kerpely, in 1936. He kept this position until 1945 and then after the reorganization of the University he worked at the University of Agronomy until April of 1949. As a professor he retired in 1949 but in 1952, at the suggestion of the Minister of Agriculture, he was appointed head of the Department of Experimentation of the Agricultural Research Institute at Martonvásár where he remained until 1956.

During his almost 50 years of service to his country he held the following important positions: from 1933 to 1937 he was director of the National Experimental Station for Plant Production at Magyaróvár; in 1943—44 dean of the Agricultural and Veterinary Faculty of the Technical and Economic University; 1944—45 assistant to the dean and head of the Department of Agriculture. In 1945—46 he was the first dean of the agricultural faculty of the University of Agronomy and in 1948—49 head of the Budapest department of the University of Agronomy. From 1939 to 1944 he was a committee member of the Association of Natural Sciences; president of the Dept. of Botany of the same Association between 1945 and 1948 and president of the Dept. of Agriculture between 1943 and 1944. He was a member of the board of directors of the National Association for Agriculture and between 1938 and 1944 he was soil cultivation and plant production editor of "Köztelek", a periodical, and co-president of the same department. Since 1944 he was corresponding member of the Hungarian Academy of Sciences, then — after the reorganization of the Academy — he became its consulting member in 1947. After having been a corresponding member again he was elected a regular one and given the title of Academician, in 1960. Since 1950 he held the following positions at the Academy: member of the special committee on plant production that of the committee on philology; on meteorology, then member of the editorial board of the publications of the 4th section; editor-in-chief of *Acta Agronomica*; president of the sub-committee on artificial fertilizers and finally president of the sub-committee of the 4th section.

This diverse activity did not however prevent him from participating in the work of almost the entire field of plant production; he was anxious to participate in every sphere of activity. Through nearly 40 years he published not only a great number of articles, studies and books, but participated also in other valuable activities such as being the first to investigate and initiate many agricultural, primarily plant production, projects the solutions of which led to the possibility of increasing yields.

Especially works that treat methods of increasing the quantity as well as the quality of wheat are important. He began this work around 1914. After the First World War he played a very important role in improving wheat production and quality. He treated the question in several articles and then in 1938 in publications of the Ministry of Agriculture he released the results of national comparative performance trials of varieties in a book published by the Ministry of Agriculture.

Being equally or even more involved in the organization of maize production he evaluated the production of various kinds of maize in Hungary. In 1932 he wrote a book entitled *Maize Varieties and their Production* ("*Kukoricafajták és termesztésük*") and 7 years later another one about the results of several years of country-wide experiments with Hungarian varieties of maize. These works actually have formed the basis of modern maize production in Hungary. Almost 20 years later, in 1957, he again intensively treats the question in his book entitled *Maize and Its Production* ("*A kukorica és termesztése*", Academy Publishers), proving how much he liked the topic and considered it important for Hungarian agricultural production. In this work he described the importance of the latest results and experiences gained in production and breeding (hybrid maize) for the future improvement of maize production in Hungary.

He also intensively studied the problems posed by the extensive cultivation of autumn barley in Hungary.

His work on wheat and maize growing and his participation in the organization of its production are regarded to be of pioneering significance. His work had important national consequences for the production of both these crops.

About the same time he was deeply concerned in studying a special method for increasing the yield, i.e. the clarification of the agro-technical methods of irrigation by sewage.

Far-reaching contributions were also made by him to increasing fodder production in Hungary. He mainly tried to insure the success of production by introducing new plants better suited for the climatic conditions of Hungary and by naturalizing new plants. Here we have to mention the tests on the production of sorghum fodder (grain and sugar sorghum and Sudan grass), the introduction of the different varieties and the description of their agro-technology. He also spent a lot of time and energy clarifying questions related to soy production — and the pertinent agrotechnical problems — which was just beginning in Hungary. Along with these works we should mention the clarification of the use values of our domesticated plants of the *Panicum* and *Setaria* groups and also the description of less known varieties. During this period many articles and studies similarly treated white Bokhara clover as a green manure and fodder plant.

In the difficult years of the Second World War and taking advantage of the possibilities of the following period, he energetically continued his work on the utilization of sorghum fodder, the popularization of new varieties and the study of their economic value and production. Today some of these have already become very important bases of our fodder production while others will become so in the future.

Making use of all the given possibilities during these years he again turns to the problem of double cropping and in 1952 after compiling the results of his research he wrote a book entitled *The Methods and Plants of Double Cropping* ("*A szántóföldi kettőstermesztés módszerei és növényei*") which is still used today as a handbook.

Finally let us mention what remained his favourite topic even close to the end of his life: proving the relation between tree planting and agriculture, the study of important questions of soil conservation which he treated in several articles and lectures. His motives behind this favourite and extensively

studied sphere of problems reveal his deep concern not only his country and nation but for the entire community of mankind. This is most clear in the closing thought of one of his publications:

"Protecting its arable land is one of the most important duties of the nation. In quite a few cases history has shown that neglect of the land leads to the impoverization, decay and ultimately to the ruin of the people. For such conditions encourage invaders. Future generations will not pardon the lack of knowledge and foresight of today's peoples resulting in letting arable land basic to human existence go to waste, turn into deserts, karst. Modern man, with his culture and technical knowledge, should be able to reverse, instead of hasten, this disastrous process. Modern man must not be guilty of the same sins, fall into the same traps as did the people of the Middle Ages or ancient times."

During this period of ceaseless activity he published 10 books, 49 extensive studies, 249 long and 74 short scientific articles, 88 reviews and summaries and took part in more than 30 meetings and congresses.

For this extensive scientific activity he received in 1932 the "Pál Markó" writers' award given by the National Association for Agriculture, a medal of merits in "Socialist Work" [in 1954] and the Second Class Kossuth Prize in 1957.

His portrait would be incomplete if we omitted his work as professor. He gladly accepted this position with the conscientiousness of one about to complete a life-long ambition. He was able to fully express himself in this role. Besides doing research work he spared enough time for his students and was always ready to unstintingly help all of them throughout 15 years of teaching. He was very demanding and his great knowledge made him seem gigantic in the eyes of his students who will always remember him. Those who were more personally acquainted with him still do not unanimously agree on what made him great: his knowledge or his will, his thirst for knowledge which knew no obstacles. He was valuable to his nation not only as a teacher, researcher and scientist but also as an individual: he was bold and honest, he always told the truth; even among discouraging and strained circumstances he unshakably held to his scientific convictions.

Although he has passed on his spirit will be preserved in his accomplishments. His efforts to solve and clarify problems encompassing almost the entire sphere of plant growing have set the standards in our practical and scientific work for a long time to come. *Non omnis moriar*. Such work is not in vain.

J. BAJAI

More Important Works of János Surányi

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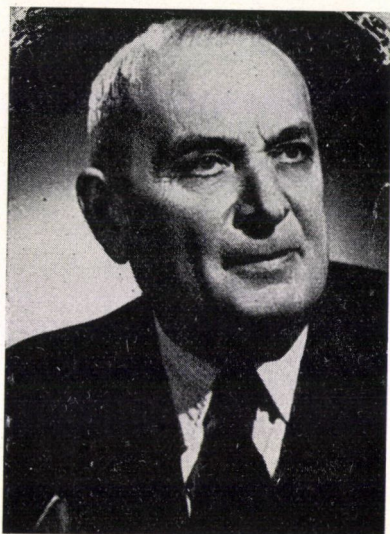
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GÉZA LENGYEL

1884—1965



On June 4, 1965, one of the Nestors of Hungarian botany, GÉZA LENGYEL retired professor, died unexpectedly at the age of 81.

His death meant the loss of an extremely versatile scholar and excellent scientist who was very active in several branches of theoretical botany (anatomy, flora research and taxonomy) as well as in agricultural research, primarily seed studies. He can be regarded as the founder of apiarian botany. He was the editor of *Magyar Botanikai Lapok* and *Botanikai Közlemények* and had been active in the Department of Botany for a long time.

GÉZA LENGYEL was born on December 23, 1884 in Salgótarján. He had been studying in Budapest from elementary school until his graduation from the Arts Faculty of the University of Science. There in June of 1907 he completed his education "summa cum laude" as Doctor of Botany, Zoology and Physical Geography.

His doctoral dissertation entitled "*Az európai Corispermum és Camphorosma fajok anatómiája*" (The Anatomy of the *Corispermum* and *Camphorosma* Species of Europe) was written under the supervision of SÁNDOR MÁGOCZY-DIETZ at the Institute of Botany of the University who, recognizing the talent of the young GÉZA LENGYEL, appointed him in his 4th term of study as his assistant. For four years he had been working together with S. MÁGOCZY-DIETZ studying primarily anatomy, taxonomy and botanical geography.

After nearly four years of this an extremely important event took place in the life of GÉZA LENGYEL which determined the whole course of his future scientific activity. In December, 1908, he was appointed research assistant at the Seed Control Station headed by ÁRPÁD DEGEN since 1896. In developing and organizing the Institute ÁRPÁD DEGEN was led by the only correct principle that an institution which would reach the highest up-to-date scientific

standards of the age could be set up and developed only if, in addition to the proper equipment and rich library resources, well-trained experts with a thorough theoretical knowledge were employed. This is why GÉZA LENGYEL, known by DEGEN already during his university studies, was chosen.

ÁRPÁD DEGEN had two main focusses of interest: first the classification of higher plants and flora research. In this field he had achieved an international reputation primarily for his study of the Balkan area. Secondly, in connection with his profession he studied agricultural botany, especially the problems of seed control.

When DEGEN selected the young GÉZA LENGYEL he made a wise choice because the latter was to become his most faithful associate and closest collaborator. GÉZA LENGYEL worked and acquired a broad knowledge in the two major fields of interest of his master.

DEGEN's oeuvre was the research and processing of the flora of Velebit. GÉZA LENGYEL who accompanied him on every field trip had a significant part in this work. He often traversed the entire Dinaric mountain range in order to study the flora of Quarnero, Croatia, Dalmatia, Bosnia and Montenegro. Several reports of this may be found in our special literature.

His second important field of research was the flora of the Low Tatra. Receiving a commission for the work from the Hungarian Academy of Sciences, he succeeded in collecting the material but was already unable to prepare it for publication.

He frequently visited the entire region of contemporary Hungary, but visited as well Switzerland, the whole Austrian Empire, Poland, the Ukraine, the Balkans and was officially sent out to almost every country of Europe.

By publishing the rich botanical finds of his trips he furnished important data about Hungary, the vicinity of Budapest, Pilis, Heves and Abaúj-Torna Counties, Bátorliget, Pótharaszti Puszta and described his trips to Cárku and Quarnero. An important series of works was that in which he elaborated the botanical geography of the experimental forestry areas for the VIIth International Congress of Forestry Experimentation held in 1915. In this frame work he set about treating the experimental areas of the Great Hungarian Plains at Királyhalma, those near by Bisztra and Hidasliget, and of Vadászerdő nearby the Maros River, while he completed a study of the botanical geography and flora of Sturechágó between the Great Fatra and Low Tatra in the northern Carpathians and one of the experimental forest areas of Likavka located in the Chocs mountains on the boundary of Árva and Liptó.

His flora research centered mainly on a few critical families. Thus he began to study the roses and the *Hieracia*. He published critical taxonomical observations, smaller studies, new species, and morphological descriptions of several families (*Centaurea*, *Knautia*, *Dianthus*, *Vicia*, *Veronica*, etc.).

Besides his work in theoretical botany GÉZA LENGYEL was an excellent scholar of the various branches of applied botany allied to agriculture and other fields. When he had been transferred to the Institute for Seed Control (today the National Seed Inspectorate) his knowledge of anatomy proved to be very profitable for making thorough studies of seeds.

Not yet being 24 years old when in 1908 he was appointed to the Institute for Seed Control where he was to spend the major part of his life and do his greatest work. He will have remained with the Institute until the end of 1940 when he asks to be retired. He was quick to join the field and pasture

improvement movement and was very active in the compilation and preparation of the 14 volumes entitled *Magyar Fűvek Gyűjteménye* (Collection of Hungarian Grasses) and *Magyar Sásfélék, Szittyófélék, Gyékényfélék és Békabuzogányfélék Gyűjteménye* (Collection of Hungarian Sedge, Rush, Mat-grass and Cat's Tail) which DEGEN had launched. Moreover, after DEGEN's death he concluded the series with the IXth volume.

With a commission from the Ministry of Agriculture he inspected and supported the production of grass seeds and attempted to rectify the errors overspread in special literature concerning this topic.

As far as his official activity was concerned he concentrated on seed production and the production of fodder mainly among local environmental conditions. His studies on origin would have been made much more difficult without his knowledge of plant geography and taxonomy. He concentrated on one of our important export items, lucern seeds. There was an important economic interest in proving without a shadow of a doubt the Hungarian origin of lucern seed. In 1929 he fully clarified this question in his work and at the same time he released the method of examination which he had evolved. In Switzerland this work was translated into German and became known in international literature. Another work on a similar topic was published in German, Polish and Swedish in 1935. He completed a work of paramount importance concerning the origin of red clover seed but due to the great expense involved in printing the great number of tables this could not be published during the war period. He began a similar study of white and crimson clover seeds, but unfortunately his retirement in 1940 as well as the war terminated this work.

He participated in advanced courses for millers, conducting several of these courses. In connection with this work he wrote in 1937 a study of weed-seeds and plant pests of wheat.

In collaboration with the Institute of Zoobiology and Feeding he studied the waste remaining after seed cleaning, i.e., the analysis of screenings and the determination of their fodder value (1927).

His report about the work of the Institute was published in four parts (1927—1940). In it he set the standards for national seed production and trade in light of statistics having treated approximately 600 different seeds and altogether 1.5 million data.

Besides his scientific work he was in charge of the training of the personnel of seed-cleaning and commercial cooperatives and companies between the two world wars. On about 30 occasions he conducted seed control courses of 1 to 2 months and he thus became a regularly consulted adviser in the field.

During his work with seeds he became an outstanding expert both at home and abroad. He succeeded in solving many problems of Hungarian seed exports for which he did a lot of popularizing work and used his personal influence; he worked hard for the agricultural exports of our country. He enjoyed a growing international reputation and his work was fully appreciated by being elected first the president of the International Fodder-Committee in Stockholm in 1934 and then in 1937 president of the Permanent Scientific and Nomenclature Committee of the Association Internationale d'Essais de Semences in Zurich.

He was intensively studying the apiarian aspects of applied botany and reached important conclusions, therefore he can practically be regarded as

the founder of apiarian botany in Hungary. After a series of articles he published in 1943 a volume entitled *Méhek és virágok* (Bees and Flowers) which fully discusses the theory and practice of this important topic. He gave lectures in apiarian botany at several apiarian courses too. In 1931 he became an honorary member of the National Apiarian Association.

He fully studied the relation of man to flora. A work on this topic was at the press in 1944 but its publication was hindered by the war. Only in 1948 could his results be published in a work edited by SÁNDOR JÁVORKA and entitled *Viruló természet* (Flowering Nature).

Besides his extensive and versatile theoretical and practical research work GÉZA LENGYEL was very active in organizing scientific life, as an editor and leader. (He was the editor of two botanical periodicals.)

This activity consumed much of his time and energy. If we thumb through both periodicals we often come across his literary reviews, reports concerning the work of the Department, obituaries written for botanists. Among these latter his necrology for GYULA GÁYER (1934) and ÁRPÁD DEGEN rank among the most excellent of their kind in Hungary. His similar literary reviews, commemorations, short publications, explanatory works, and works written in answer to various questions as well as popularizing articles can also often be found in the pages of *Természettudományi Közlöny*, *Erdészeti Kísérletek*, *Gyógyszerész Folyóirat*, *Köztelek*, *Kísérletügyi Közlemények*, *Magyar Méh*, etc.

His extensive work was fruitful and he soon became an adjunct, head adjunct and director. After DEGEN's death he continued propagating DEGEN's spirit and in 1937 he was appointed experimental director.

The Faculty of Economics of the University of Budapest qualified him as lecturer of seed research courses in 1929. In connection with this he frequently participated in the training of agronomists. The successor of ZOLTÁN SZABÓ left the country in the winter of 1944/45 and GÉZA LENGYEL, after winning the competition for the job announced by the department, was appointed professor in 1945. He very diligently undertook this task and the slow progress of the department could only be attributed to the inadequate opportunities provided by the immediate post-war period. Two years after his appointment to the professorship he was given another sign of recognition in 1947: he was selected a corresponding member of the Hungarian Academy of Sciences.

Less than two years later, in 1949, agricultural higher education was reorganized and as the result of this the agricultural academies, or rather the rural departments of the Agricultural Faculty of the University of Agriculture were closed; everything was centralized in Budapest. In the wake of this amalgamation GÉZA LENGYEL was retired for the second time.

This wrought a significant change in his life. He perfectly renounced the world. He never visited his colleagues of professional circles. This self-imposed reclusion was ended by his sudden death.

His name will live on in his work and we, his colleagues, will continue to pay tribute to his memory.

Z. E. KÁRPÁTI

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